THE IRON TRADE REVIEW

VOLUME XXIV. CLEVELAND, O., JANUARY 29, 1891. NUMBER 5.

THE IRON TRADE REVIEW.

A JOURNAL OF THE
IRON AND STEEL INDUSTRY, THE MACHINERY TRADE AND KINDRED INTERESTS
IS PUBLISHED EVERY THURSDAY BY THE
CLEVELAND PRINTING AND PUBLISHING CO.,
27, 29 *dnd* 31 *Vincent Streeet, Cleveland, Ohio.*

TERMS, (strictly in advance):

One year	$3 00
Six months	1 50
Three months	75

Advertising Rates Furnished on Application.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER.

CLEVELAND, O., JANUARY 29, 1891.

THE WEEK IN IRON CIRCLES.

General Features.

With pleasure we have to report a distinctly marked improvement in the general iron market. Consumers who have delayed purchasing iron are now in the market, and there is a fair inquiry both from the East and from the West. Purchases at tide-water are quite heavy, and we think the buying movement will spread so that a round lot of iron will be sold to consumers in the West and Northwest. The increase in unsold stocks of pig iron December 31 (as reported in another column) it is believed arose from consumers in December preferring to use up all the iron held in their yards instead of ordering from the furnace, the tightness of the money market at that time making this appear the part of wisdom, so that it is not believed that the amount of iron in the country to-day is greater than during December. The outlook is more encouraging for steady buying, but it is thought there will be no special advance, at least at present. Prices at Louisville remain low, but the extreme low offerings current during the first part of the month cannot be duplicated, and the market is on basis of $10.25 for grey forge. There are isolated cases of sales at less than this, but furnaces are booking orders at $10.25 and can sell freely at this price. Furnace agents and dealers at Cincinnati are not disposed to complain of the volume of business current the past week. The aggregate of orders is quite double that of the corresponding period a year ago, when furnaces were refusing to recognize the decline which had set in. Prices throughout the entire list range from $3 to $4 per ton less than in January, 1890. There has been a little stiffening in values. The very cheap lots that were being forced about the first of the month have been absorbed, and current make is greatly reduced. There are some heavy stocks reported here and there, but they are in strong hands and not offered at current prices. Southern coke furnaces have no iron unsold. The diminution in consumption that was generally expected is hardly noticed thus far. The Chicago market still continues to show a fair amount of activity, various sales of good size having been made to large consumers. These transactions have been mainly in the way of local coke and Alabama irons purchases being for foundry purposes. Prices have ranged exceedingly low, which have led some buyers to form the conclusion that there is no bottom to the market. The explanation is, that many of the furnace companies, North and South, are still pressed for money, consequently are willing to sacrifice values in order to effect sales. The general outlook for the consumption of pig metal continues good. Prices must materially advance, however, on all grades—coke and charcoal, Northern and Southern brands—before furnaces competing in the Chicago market will receive fair equivalent for their product. Lake Superior charcoals still continue to be in small demand. The leading brands are all being held at $18.50, Chicago, but several of the smaller furnaces are offering to cut this figure 25 or even 50 cents per ton. At Detroit, there has been very little change in the market during the week. Consumers are still pursuing the same waiting policy that they have been for the past two months. Orders for small lots are coming in, and prompt delivery is desired, thus showing light stocks on hand. Lake Superior charcoal is a little more in demand, but the market for all grades continues dull, and prices weak. The past week has developed no new features in the St. Louis local market. Purchases for current requirements continue on a modest scale at very low prices. Now that the Southern miners' strike is over, it remains to be seen how many furnaces will resume making iron and selling on the present market. Purchasing in Buffafo has been on a much larger scale and well distributed among foundries doing a variety of work. Prices generally are firm, with concessions, however, by furnaces carrying large stocks.

The Local Situation.

While there is nothing new in the local situation of special interest, a number of local interests are seriously affected by the happenings of the week, in the mining districts and elsewhere. The first piece of important information that reached here this week, is the intended purchase, by the Vanderbilt interests, of the Chapin and Negaunee mining properties, along with the so-called Schlesinger road, the Escanaba, Iron Mountain and Western Railway. This road, as is well known, was built as a direct freight carrier for the Schlesinger group of mines, and in opposition to the Northwestern road, which is owned by the Vanderbilts. An attempt was first made to procure for the Vanderbilts the controlling interest in the Chapin mine, with a view of diverting from the new road its principal business, and thus make it practically valueless as a dividend-paying investment; but the Chapin people declined to separate their interests in this way, and there is now little doubt that both the mines and the railway will be sold together, and at one figure. The purchasers, it is understood, will take only the controlling interest in the mines, which carries with it the control of the railway, and, while the purchase price is a matter of speculation so far, it is believed that the transaction will involve in the neighborhood of four million dollars. The pig iron situation is likely to take on an entirely new aspect, in view of the step contemplated by the coke syndicate. The united action of the pig iron producers has so far convinced the coke people that something must be done to help the trade, as to bring about a conference of all the kindred interests, with a view to mutual action. The result has not yet materialized, but the writer is reliably informed that it is the intention of the coke syndicate to stop the further production of coke. One independent producer, about two-thirds of whose output goes to a single firm, may not join this action, but that will make very little difference as to the general result. There are a few concerns, South and West, that have considerable quantities of coke on hand—one Pittsburgh firm having 75,000 tons stored away, and a Chicago firm 80,000—but the stopping of the coke ovens by the syndicate means, in effect, the shutting down of every furnace west of the Alleghenies, and depending upon Connellsville for coke. One coke man, when interrogated about the intended stoppage, at first denied all knowledge of it, but later on admitted that such action might be probable, so as to assist in the reduction of the price of labor, which would eventually have to be made when the furnaces start up again, to work on cheaper raw materials, among which coke must be included. Some of the pig iron producers say that the coke people are not sincere in this assertion, as the profit on coke is out of all proportion with the starvation prices which have ruled the iron market for months. At all events, the coke producers are still engaged in formulating their plan of action, and, although they may, for obvious reasons, deny that they mean to shut down, the developments of the next few weeks will fully demonstrate the facts as here set forth. The continued idleness among furnacemen hereabouts is a standing menance to the ore and vessel interests, while the railways profess to be handling all the freight they can take care of. Nevertheless, the freight shortage is apt to play an important role in the reconstruction of rates, which must undoubtedly come before a resumption of work. The ore production of 1891 is a very uncertain quantity, some producers placing it as low as five million tons. The vesselmen, on the other hand, assert that a booming lumber trade will help them out, and that they will not suffer in consequence.

CUBA AND HER IRON ORES.

While it is true, as stated authoritatively by *The Iron Trade Review*, that Cuban ores will play no part in the markets this year, the development of new properties on that island is progressing with great rapidity. In spite of the fact that the first iron claims were recognized less than ten years ago, there are now three American companies opening up the rich deposits and providing shipping facilities to the coast and to the United States. These corporations are known as the Juragua, the Spanish-American and the Sigue. The first is the oldest and is operated, as is well known, by the Pennsylvania Steel Company and the Bethlehem Iron and Steel Company. A correspondent of the New York *Tribune* is authority for the statement that the Juragua represents an investment of $2,500,000, employs 2,000 miners and railway workmen, and requires for the transportation of its ore a fleet of twenty steamers. During 1890 the iron ore exported to the United States amounted to 357,060 tons, with a valuation of $775,180.99, and the manganese to 25,187 tons, valued at $199,910.46. For 1891 it is estimated that the exports will reach $1,500,000 at the lowest estimate. The above is the record of the Juragua company, the other syndicates, as we understand, not having yet become shippers. The ore so shipped to this country has been entirely consumed east of the Allegheny Mountains; how far West the product of the other mines will come remains to be seen.

These are important facts, and a brief glance at the possibilities of the future may be of interest. Upon this point let us quote from the correspondent above mentioned:

The policy of reciprocity as applied to these Southern countries has been supposed to be restricted to the exchange of such products as cannot be supplied on one side or the other. Brazil which needs to import its food supplies and manufactured goods, can profit largely by exchanging for these on the freest terms and with the fewest possible restrictions its coffee, sugar and rubber, which cannot be produced in the United States. In the present instance reciprocity has a wider application. The iron product of Cuba, already large, and apparently capable of immense development, is brought into a market supplied and sometimes overstocked with American ore. It is not the precise kind of reciprocity which has been advocated in Pennsylvania; but it does operate disadvantageously for American interests, as can be readily shown. In order to carry the ore from Cuba to the United States a large fleet of steamers has to be employed. These vessels at first went back empty or with ballast, but it was not long before they were taking coal to the West Indies. The export of American coal has been largely increased in this way, and since these ore steamers have special facilities for carrying it, and can afford to take it at low rates rather than to go South without cargo, they have already displaced English coal in many of the islands. In other words, while the Spanish miners in the iron deposits of Eastern Cuba are, to a certain extent, competitors of the ore workers in the United States, they are also opening a new market for Pennsylvania coal. Cuban iron ore shipped to the American market facilitates the exportation of Pennsylvania coal to the West Indies, and active competition with the Cardiff industries. Meanwhile, the American iron miner is protected by the tariff and paid higher wages than the Spanish worker employed in these mountains. The duty paid on the Santiago ore when it enters the United States operates to increase the earnnings of American coal miners, and furnishes a margin for higher wages to American iron miners than are received by the same class of Spanish workers. At the same time it does not prevent the employment of American capital in developing the resources of Cuba, and enlarging the export trade of the United States.

Growing out of this interchange of commodities will come, the correspondent asserts, free Cuban sugar to the United States and free American flour to Cuba, American iron ores being at the same time protected by the present tariff. As we understand it, the new syndicates do not ask that the tariff on iron ore be removed or modified—we wish we could say as much for the patriotism of the older company—and there is no doubt they can successfully operate their mines and still pay the duty. In other words, while operating on foreign soil, they still recognize themselves as Americans, bound by patriotism as well as policy, to sustain our present protective system. This is both broad statesmanship and good business, and is certainly to be commended.

THE STEEL RAIL SITUATION.

During 1890 shipments of standard-section steel rails were made by mills in the Steel Rail Association to the amount of 1,388,186 tons. Adding the product of the former Allegheny Bessemer Company, 87,000 tons, the total reached was 1,475,000 tons. Of this aggregate Western mills made 911,000 tons, and the Eastern mills 564,000 tons. The present market price of steel rails is normally $30 per ton. The outlook for 1891 is not, however, very encouraging for a maintenance of this price, and an agreement has virtually been made by the Eastern mills to effect a consolidation of interests. Concerning the present status of the negotiation, the *Iron Age* says:

The announcement that the combination had been formed and is now effective, is decidedly premature, and some time may elapse before it is. While the chances are in favor of the ultimate adoption of the plan, the possibility still exists that the efforts made may come to nothing. The positive statements concerning the negotiations of the two Scranton mills which have gone the rounds are similarly premature. A number of details must still be adjusted before the Lackawanna Iron & Steel Co become the successor of the Lackawanna Coal & Iron Co., and the Scranton Steel Co. It is highly probable that the consolidation will be effected, but there is a remote possibility that it may still fall through.

The plan proposed is somewhat similar to that suggested for the cut-nail industry of the Ohio Valley. Each concern is given a certain percentage. All are at liberty to sell as much as they like and at any price they may deem satisfactory. At the end of each month the aggregate of the sales is redistributed according to the fixed percentages. Those who have exceeded their percentage pay a penalty per ton for the excess, the only material change in the plan last agreed upon provisionally, from the one formerly discussed, relating to the amount of this penalty. Every manufacturer, therefore, takes his chances that he may sell too much, and thus become liable to heavy payments, which are distributed among the more cautious rivals.

In the meantime, the market, North, East and West, is in an expectant attitude. The Scranton works are reported to have sold 15,000 tons to a New England railway on cash terms, but the price is kept quiet. Chicago mills are "expecting" some desirable orders soon, but as yet they have not materialized. As a whole, the situation is not at all reassuring for the steel rail men.

TO MAKE ADAMS DIRECT-PROCESS STEEL

The announcement is made that a large plant is to be erected at once in Pittsburgh for the production of open-hearth steel direct from the ore by what is known as the "Adams process." A full description of this process has already appeared in our columns, and need not here be repeated. It is sufficient to say that it appears to make an entire new departure in steel manufacture. One of the important results, as pointed out by the Pittsburgh *Dispatch*, is that it bids fair to displace Swedish iron. Swedish has been imported to the extent of over 75,000 tons per annum, and at a cost of from $80 to $135 a ton. Taking the average at $105 a ton the cost per annum to the American manufacturers has been in the neighborhood of $8,000,000. The *Dispatch* further says:

The Steel & Improvement Co recently made, at their furnace in this city, crucible steel stock higher in quality than the best Swedish bar, and at a very much lower cost than the cheapest imported stock for similar purposes. According to the analyses made by the Pittsburgh Testing Co. the results of three different heats were as follows: Carbon, .37; phosphorus, .010; carbon, .15; phosphorus, .003; carbon, .06; phosphorus, .003. The material showed no manganese or sulphur, and was below .01 silicon. The best Swedish bar averages about .012 in phosphorus, and .03 or .04 in silicon. The makers of tool and high grade steel claim a superiority of the product made by the Adams process, as compared with the Swedish bar. Another difficulty with the imported material, which has been overcome by the new product, is the lack of uniformity. Swedish bar varies very considerably in carbon, while with the Adams process it is claimed that there will be absolute uniformity.

The same paper further says that the new plant will have an annual capacity of nearly 20,000 tons, and that two or three other large companies have adopted the process.

THE PIG IRON SURPLUS.

The stocks of pig iron on hand and unsold, December 31, 1890, were the largest known in the history of the American iron trade. According to the official figures of the American Iron and Steel Association, the unsold stocks on hand at the date mentioned were 681,992 tons, as compared with 389,244 tons June 30, 1890, and 277,401 tons December 31, 1889. The detailed figures are given below:

States.	Tons of 2,000 tons. Dec. 31, 1889.	June 30, 1890.	Dec. 31, 1890.
New England	19,897	15,344	11,572
New York	42,607	38,323	64,381
New Jersey	5,800	500	25,078
Pennsylvania	67,005	135,303	204,535
Maryland	1,372	1,890	1,637
Virginia, N. Carolina, Georgia and Texas	8,130	19,149	28,707
Alabama	39,916	58,717	69,957
West Virginia	.....	1,080	11,414
Kentucky	5,382	8,176	9,413
Tennessee	7,982	11,089	28,142
Ohio	27,579	46,192	116,608
Michigan and Indiana	25,102	18,339	56,452
Illinois	.....	.....	19,504
Wisconsin	9,428	14,424	
Missouri and Colorado	8,881	13,424	29,434
Pacific States	8,220	7,304	5,168
Total	277,401	389,244	681,992

It appears that at the end of last year there were 311 furnaces in blast and 251 out, while at the same time in 1889, 344 were in blast and 226 out.

THE UNITED STATES LEADS THE WORLD IN IRON.

Official figures of the pig iron production of the United States during 1890, now for the first time published by the American Iron and Steel Association, show that the total of production was 10,307,028

net tons, or 9,202,703 gross tons, a gain of 21 per cent. on the production of 1889, which was in turn 17 per cent. greater than in 1888, the product of that year and 1887 being less than seven-tenths of the total of 1890. This total is 1,200,000 gross tons above the product of England for the same period year; but as compared with England's greatest year of iron production, in 1882, it is only 600,000 tons in excess. Thus it will be seen that last year the United States exceeded England's iron production for the same period, and in addition placed their high water mark of iron product 600,000 tons in excess of England's greatest product in any single year. This high-water mark, we apprehend, will remain *in statu quo* for a year or two at least, and then ——?

WILD STATEMENTS CONCERNING PITTSBUGH'S IRON INDUSTRIES.

TO THE EDITOR OF THE IRON TRADE REVIEW:

In a circular bearing date of January 8, 1891, issued by a prominent iron agent and commission broker of Pittsburgh, I read as follows:

"December closed a month of stagnation. How soon the iron business has changed from prosperity and paying prices to a condition that makes this 'a Winter of discontent' to all of us: The outlook for 1891 would seem to be problematical. The country at large is prosperous, but the iron trade cannot stand existing prices. There must be a lessened production before prices can improve; and those furnacemen who are preparing to shut down for a time are acting wisely. If all furnacemen would do likewise for ninety days, it would pay. This is done in the anthracite coal trade, why not in the pig iron? The Scotch furnacemen systematically reduce production when prices weaken."

In the face of this statement, one Nick Dale, of Pittisburgh, prepares a statement which is found on page four in *The Iron Trade Review*, under date of January 15, 1891, who fortifies himself with the astounding declaration that his premises and conclusions are correct, and will not be denied. That there are "millions in the Pittsburgh iron and steel mills," and gives the figures as to the output of each firm, and the profits realized by each company, out of the business done in 1890, which showing is, I confess, remarkable, and somewhat questionable to an experienced iron man. For example, I refer to the Soho mills, of Moorhead, McClean & Co., who on 15,000 tons of muck bars and 30,000 ton finished iron and steel product, realized a net profit of $450,000; equaling $15.00 per ton, net margin, supposing, of course, that they absorbed their 15,000 tons of muck bars in the 30,000 tons finished product.

I next cite the statement covering the operations of Shoenberg & Co. whose margin on 13,500 tons of muck bars, and 35,000 tons of iron and steel was $750,000, or about $21.43 per ton, net margin.

Again, I refer to A. M. Byers & Co., whose margin on 25,000 tons of pipes of various sizes is given at the enormous figures of $900,000, or $36.00 per ton. And so on with the mills who make largely their own muck bars. I base my figures on the tonnage of finished product, for the reason that the production of muck bars is only the first step in converting pig iron into finished product, and goes into the general product of finished iron.

And now comes the remarkable statement of two pipe mills, for which Mr. Dale says every ton of pipe iron has to be bought on the market. That is, the iron to make the pipe is made by other mills. First, the Pittsburgh Tube Works turned out 15,000 tons on which their profit was $450,000, or $30 per ton. Second, the Pennsylvania Tube Works made 70,000 tons, on which its profit was near $2,000,000, or $28 50 per ton. These figures, which Mr. Dale assures the public are unquestionably correct, are the more remarkable, by reason of the fact that in a number of instances, the actual earnings for the year 1890 exceeds the entire possible cost of the construction of the plants and capital employed, I may safely say. The general tone of all the iron journals east and west in the States including Dun's *Weekly Review*, has, during the year 1890, indicated a depressed and unsatisfactory condition of the iron and steel industries, which view and experience is certainly justified by the general stoppage of furnaces, and the large steel works, after annual inventories, resisting demanded advances in wages, and asking reduction in railroad freight on ores, and existing price on coke.

If Mr. Dale's published declarations in emblazoned head lines, that there are "millions in the Pittsburgh steel and iron mills," be true, and that his statements have been warranted by the various mills indicated in his boomerang, it is not surprising that labor in the mills, furnaces and coal mines and cokeries are demanding an advance in wages, or that railroad companies decline to give reduced freight rates on ores, etc. Neither is it at all surprising that the Free Trade sentiment of the country is demanding tariff reform in the interest of the many as against the protection of the few. Mr. Dale's picture drawn in the interest of Pittsburgh manufacturers, if warranted, in fact, will create a political boomerang that will more greatly astonish the people of the United States in 1892 than did the cyclone in the off year of 1890.

The writer has been engaged as an iron manufacturer 40 years, save four years in the volunteer service of the United States in 1861–5, and has ever cast his vote in favor of Protection to American industries and American labor; but is honestly compelled to seriously question the wisdom of a policy of national legislation, that must, if Mr. Dale is correct, produce a national revolution in the tariff policy of the United States in the near future.

AD INQUIRENDUM.

[If Mr. Dale's figures are even approximately correct, our correspondent's conclusions might be tenable; but we have no idea that the Pittsburgh writer's assertions can stand for a single moment in the light of actual fact. They appear to consist of one-tenth fact and nine-tenths sensationalism. In our issue of January 22, we disavowed any confidence in them.—EDITOR IRON TRADE REVIEW.]

THE STATISTICS OF THE SCOTCH PIG IRON TRADE.

In another portion of our issue [see below] will be found the usual annual statement showing the production, consumption, and stock of pig iron in Scotland during the year 1890. In former years it was the practice of the Scottish ironmasters to publish these returns on the eve of the Christmas holidays. The custom served no useful purpose, and it has been wisely abandoned. In future these important statistics are to be published in the first week of the New Year, and this arrangement will doubtless be approved both by the trade and the public. On the present occasion the returns will be read with more than ordinary attention, for the circumstances surrounding the Scotch iron trade are unusual, if not unprecedented. For three months all but half-a-dozen furnaces in Scotland have been out of blast consequent on a strike by the blast furnacemen for increased pay for Sunday work, and the situation is rendered all the more serious by the fact that no one can tell how long this extraordinary state of things is destined to continue. Meanwhile the returns thus published by Messrs. M'Grigor, Donald & Co., on behalf of the Scotch ironmasters, are worthy of close scrutiny, for they constitute to a large extent the dominant factor which has to be reckoned with in forming an estimate of the future of the iron trade. Taking production alone, we find that it amounts to 798,333 tons as compared with 998,828 tons in 1889, or a decline of 200,595 tons. This is the smallest production since the year 1854, when the total reached 754,000 tons, but the Scotch blast furnace owners are entirely responsible for this unfortunate result, which they might easily have obviated by conceding the very reasonable and just demands put forward by their workmen. The Scotch ironmasters, we fear, will yet find that, like the dog in the fable, they have lost the substance while grasping at the shadow. Out of these 798,333 tons the local malleable iron and steel works and foundries have consumed no less than 766 395 tons, as against 762,285 tons in the preceding year. The local consumption, in fact, is growing rapidly, owing to the increased requirements of founders, and this fact will be at once apparent if we look at the figures for 1888, when they were 588,000 tons. The shipments, however, are not quite so satisfactory, for though there has been a fair advance as regards consignments coastwise, yet those to foreign parts have suffered a decline during the past three years, the total for 1890 (237,607 tons) being the lowest since 1878. This may to some extent, perhaps, be accounted for by the stoppage of production, and the difficulty of procuring certain brands that are no longer held in stock; but against this view must be taken the fact that these special grades, which at one time went in considerable quantities to the United States, are no longer in request in that market, their place having been permanently taken by native irons possessing similar qualities for foundry purposes. But the most important feature of the returns undoubtedly is that relating to stocks in makers' hands and in Messrs. Connal's warrant store. The former declined from 92,000 tons at the end of December, 1889, to 25 800 tons at the close of 1890. The great clearance that has taken place in recent times in the stocks in makers' hands will, however, be much better understood if we go back to 1888, when they amounted to 213,200 tons, the decline since then having amounted to nearly 188,000 tons. Thus makers may now be said to have only a little more iron in their possession than would be necessary for one week's consumption in ordinary times. But, of course, the blast furnacemen's strike makes all the difference. Cleveland and other centers of the iron trade are now being largely drawn upon for their requirements by Scotch consumers, and will continue to be so drawn upon until the strike has terminated. In Messrs. Connal's stocks the decline on the year is 356,123 tons—namely, from 943,775 tons at the end of the year 1889 to 587,652 tons on December 31st, 1890—or a total decline of 422,395 tons, if we include the reduction in makers' iron. This is the cardinal feature of the whole return, and its importance cannot be over-estimated. Messrs. Connal's Glasgow stock has always been the weakness—perhaps we may say scourge—of the iron trade, and any large reduction made in it cannot but have a favorable influence on the trade generally. It is worthy of remark that Messrs. Connal's stock reached its maximum in February, 1889, when it stood at 1,034,427 tons, so that the decline during the interval amounts to no less than 446 775 tons. This fact alone would lend exceptional interest to the present returns. But in other respects also the figures are reassuring, and the outlook would be regarded with much greater confidence if one could see some reasonable prospect of a remedy being found for the strikes that are now becoming almost epidemical on the other side of the border.—[Iron and Coal Trades Review.

	1890.	1889.	1888.
Production (tons)	798,333	998 928	1,017,774
Furnaces in blast (average)	66.215	84.196	84
Furnaces in blast (31st December)	6	88	77
CONSUMPTION.			
Foundries	346,782	185,896	137,805
Malleable and steel works	419.613	576,389	450,844
Total	766,395	762,285	588,649
SHIPMENTS.			
Foreign	237,607	246,793	240,273
Coastwise	203,770	185 423	173,200
Rail to England	12,956	13,620	9,759
Total	454,333	445,236	422,732
STOCKS.			
In makers' hands	25,793	92,065	213,213
In Connal's	537,652	943,775	1,031,220
Total	613,445	1,035,840	1,244,433

EACH number of *Scribner's Magazine* scores some new and pleasing achievement in magazine enterprise. We have hardly begun to adequately admire Sir Edwin Arnold's "Japonica," before we are called to express fresh admiration of Edward L. Wilson's "Mount Washington in Winter," in the February issue. Other interesting articles are "About Africa," by J. Scott Keltie, and "A Box of Autographs," by Richard Henry Stoddard.

EARLY HISTORY OF THE IRON INDUSTRY IN THE UNITED STATES.

Mr. William F. Durfee, well known to American metallurgists as the first man who made Bessemer steel in America, at the experimental works, at Wyandotte, Mich., in 1864, is contributing to the *Popular Science Monthly* a series of articles on "The Development of American Industries since Columbus." Three of these articles, "Early Steps in Iron Making," "Iron Mills and Puddling Furnaces," and "Iron Smelting by Modern Methods," have appeared respectively in the December, January and February numbers of the *Monthly*. They give a very interesting description of the beginnings of the iron industry in the United States, and we take from them the following historical items:

The first mention of iron ore on this continent was by Thomas Harriot, the geographer of the second expedition to Virginia. This expedition founded a colony on Roanoke Island, but being menaced by Indians the colonists became discouraged, and returned to England in 1586.

On April 10th, 1608, the colony at Jamestown, Va., made a shipment of iron ore to England, and 17 tons of iron made in England from this ore were sold to the East India Co. at £4 per ton. An attempt was made in the years 1620 to 1622 to erect iron works at Falling Creek, about 66 miles above Jamestown, but on the 10th of March, 1622, the buildings were burned by the Indians, and 347 persons were killed.

The first iron works built in this country that can be called successful were those erected in the Province of Massachusetts Bay, in what is now the town of Saugus, a suburb of the city of Lynn, about ten miles northeast of Boston. These works were commenced late in the year 1643 or early in 1644. The first piece of hollow ware made in America was cast at Lynn, in 1645, probably direct from the blast furnace, or, possibly, from a reverberatory furnace, as the cupola, for smelting iron, was not invented until 1790.

After the establishment of the furnace and foundry at Lynn, iron works were erected in other parts of New England, and thence the business spread into New York, New Jersey, Pennsylvania and Maryland. During the French war (1755) there were a number of furnaces in operation, and cannon balls and bombs were cast in great quantity. Many of those works afterward furnished similar supplies to the Continental army during the Revolution.

No drawings of the early iron works erected in this country have been preserved. Mr. Durfee therefore describes the work in existence in Europe at that time, copying quaint illustrations of them from books published in France in the eighteenth century.

In 1731 there were in New England six furnaces for hollow ware, and 19 forges or bloomaries for bar iron. There were then no furnaces for pig iron exclusively, nor any refineries for pig metal; there was one slitting mill and a and a "manufacture of nails." In that year there were no iron works in New York, but in New Jersey there were one furnace and "several forges." Fifteen furnaces and 30 bloomaries represented the growth of the iron industry during the 86 years following its birth at Lynn.

In 1750 there were four rolling mills or slitting mills in the colonies. In that year an act was passed in England prohibiting their further erection, and this act was zealously enforced. An instance is given, however, of a slitting mill being erected in defiance of the law at Boonton, N. J., the mill being hidden below a mill for grinding grain. From 1750 to the Revolution the iron industry was chiefly confined to the manufacture of pig and bar iron in the furnaces, forges and mills already erected and of castings from the blast furnaces.

During the Revolution one of the most notable events connected with the manufacture of iron was the making of the great iron chain which in 1778 was stretched across the Hudson River, at West Point, to prevent the passage of the British vessels. It was made at the Sterling Iron Works, about 25 miles back of West Point. The total weight of the chain was 180 tons.

The first rolling mill erected in the United States to "puddle" iron and roll it into bars was built at Plumsock, Fayette County, Pennsylvania, in 1816 nd 1817, the puddling process having been invented by Henry Coe, in England, in 1784. In the early practice in this country the operation of puddling was preceded by the operation of refining, carried on in an apparatus known as a refinery. The puddling of the refined iron was done on a "sand bottom," the decarbonizing being performed by the heated air passing over the metal. Later, the "iron bottom" introduced by Samuel Baldwyn Rogers was used, and the preliminary process of refining was dispensed with.

The next improvement in puddling-furnace practice was the invention of the rotary squeezer by Henry Burden, of Troy, in 1840. The manufacture of Nasmyth's direct-acting steam hammer was begun in Philadelphia in 1843.

The first successful use of anthracite for smelting iron in blast furnace was made in 1830, at the Pioneer Furnace, in Pottstown, Pa. The furnace in that year made a continuous blast for 90 days, and secured for its proprietor a premium of $5,000, which had been subscribed by citizens of the State. On July 4, 1840, the first cast was made at the furnace of the Lehigh Crane Iron Co., at Catasauqua, Pa., erected by Mr. David Thomas. This furnace continued to be successfully operated with anthracite until 1879, when it was torn down.

Mr. Durfee's articles are handsomely illustrated, and written in an interesting and popular style. They will be continued in the March number of the *Popular Science Monthly*.—[Engineering and Mining Journal.

Glass Works Connected with Blast Furnaces.

In connection with blast furnaces it would be an easy matter to erect glass works, and by proper arrangements, to transfer the hot slag into glass furnaces, and thereby retain a large part of the heat already developed. Should the slag not contain a sufficient quantity of silica, an additional amount of sand might be added. Should it be too silicious, and thereby produce a too hard and brittle glass, the required quantity of sulphate of soda might be added to produce a glass of the ordinary conditions. The installation of the furnace might be so arranged as to utilize some of the waste gases of the blast furnaces. The furnaces could be built without pots, and tank furnaces—similar to those used in the iron manufacture—might be used with slight modifications, furnaces in the style of Siemens' continuous melting p'an' With the exception of color, this glass could be produced in all degrees of hardness and softness suitable for different purposes.—[Charles Colne.

Eastern Pig-Iron Men in Despair.

The iron manufacturers of Eastern Pennsylvania have been considering the advisability of holding a meeting to pass a resolution to close all the blast furnaces in this part of the State. This meeting is likely to be held at any time in the near future. The manufacturers of Western Pennsylvania have sent word to the Eastern men asking their co-operation in the move to draw the fires from every furnace in the State. A number of the influential manufacturers whose offices are in this city have sent word back to Pittsburgh that they are heartily in favor of closing the works for a time.

"We will agree to bank our furnaces to-morrow," said a leading pig iron man, of this city, yesterday, "if the others will do the same thing. I have written to the headquarters of the iron trade in Pittsburgh, stating that we are ready to stop at any minute, provided all the manufacturers are put under heavy bond not to start again until it is mutually agreed by all to do so. It is clear to me that there is only one way to save ourselves, and that is by showing the coke men and the railroad companies that charge too high freight rates in some instances, that we can get along without them for awhile."

While bar iron is selling for an unsually low figure, the prices of ore, coke and freightage are exceptionally high Connellsville coke was reduced from $2.15 to $1.90 per ton on January 1, but the latter figure is a ruinous one to the furnacemen. Eighteen months ago Connellsville coke sold for $1, and even less than that, per ton. At present $1.90 is charged for a net ton. The Pennsylvania Railroad charges $2.40 per net ton or $2.70 per gross ton freight on the coke from the ovens to Eastern furnaces. This is about one cent. a ton per mile, which is an enormous rate for such a long haul. There is always a loss of at least 10 per cent. in hauling the coke to the furnaces, so that the manufacturers pay to-day fully $5 per ton for all the coke that is used in their furnaces. Ordinarily the Eastern furnaces use two-thirds anthracite coal and one-third coke for their fuel.—[Philadelphia Record.

Nickel Steel.

An interesting question has been raised in regard to the priority of invention of nickel steel. In a letter to *L'Ancre*, of Saint-Dizier, Mons. Charles Walrand, a well-known French metallurgist, refers to experiments carried on at the Forges de Montataire, in rolling ferro-nickel with varying proportions of the latter metal. The idea of those who undertook these experiments was to ascertain whether ferro-nickel could not be made to replace copper and white alloys in their application because of the property of ferro-nickel of not being subject to oxidizing influences. At Walrand's instigation a certain number of physical and chemical tests were made of the specimens rolled, among them some possessing extraordinary qualities. The alloy used as a base varied in composition as follows:

	Per cent.
Carbon	0.15 to 0.05
Phosphorus	0.02 to 0.05
Sulphur	Trace.
Manganese	0.50 to 0.04
Nickel	25
Iron	74

Mechanical tests gave the following results:

1. On 15 mm. rounds, turned to 12 mm. diameter, a 200 mm. specimen, before annealing, tensile strength, 89 kg.; elongation, 19 per cent.; after annealing, tensile strength, 81 kg., and elongation, 29 5 per cent. Flats, 56 by 6 mm., tooled to 17 by 6, before annealing, tensile strength, 80 5 kg., elongation, 40 per cent.; after annealing, tensile strength, 73 6 kg.; elongation, 33 per cent.

3. 26 mm rounds, turned to 12 mm. diameter, without annealing, tensile strength, 87.9 kg.; elongation, 43.5 per cent. Rounds, 12 mm. of the diameter tested without tooling, without annealing, tensile strength, 69 2 and 72 kg., and elongation, 37 and 40 per cent., respectively.

The results of these tests led to negotiations with the Societe Ferro-Nickel, who are owners of the patents and the Creusot, with the idea of applying the ferro-nickel to special work.

They Expect to See American Tinplate.

The London *Ironmonger* of December 27, said: "The American manufacturers will have many difficulties to contend with, no doubt, but the tariff will make the home market well worthy of being strenuously fought for, and they have accomplished too much already in metallurgy to be daunted by a process such as tinplate making. We do not indulge in prophecy, but if we did we should be inclined to forecast that within three years from now a great many tinplates will be made in the United States. As a natural sequence of that impression, we would advise the Welsh manufacturers to lose no time in endeavoring to open up new markets."

Earnings of Railways for 1890.

Bradstreet's gives the gross earnings of 129 railways for the year 1890 The amount realized on a total mileage of 85,678 was $484,239,134. This is a gain of 8.6 per cent. in earnings and 2 7 per cent. in mileage. The gain on 130 roads in 1889 over 1888 was 8 5 per cent. Every group of roads shows an increase for the year, the smallest gain being that of the Mexican roads, seven-tenths of 1 per cent., and the largest that of the Southwestern roads, 12 7 per cent. In addition to the latter, three others show gains in excess of 10 per cent., viz: the Eastern roads 10.3 per cent., the Southern roads 12 per cent. and the Pacific roads 10.9 per cent. The central Western roads gain 9.5 per cent. and the grangers 8.7 per cent., while the trunk lines show the comparatively modest gain of 2.4 per cent.

AMONG THE IRON MINES.

Lake Superior Mining Notes:—

MENOMINEE RANGE.

We note, with pleasure, that the outlook at the Sheridan mine, Iron River, is very flattering. The bottom of the second level will soon be reached, and when it is, the mine will resume hoisting. At the present time it is in as good shape as any property on the Menominee range, and it will not take a very large crew of miners to raise several thousand tons of ore, which is now in sight.—[Escanaba Mirror.

At the Pewabic, the drift in the bottom (500-foot level) has been driven about 225 feet to the east, and will probably go a couple of hundred feet further. Work at the second level is being pushed, but the ore is nearly all out at the first level. Manager Hulst says the new shaft will be sunk as soon as its location can be satisfactorily determined.—[Florence Mining News.

At the Aragon, No. 2 shaft is down to the third level, and a part of the station cut out. The drift from No. 1 to this level will probably be finished this month, as less than 50 feet remains to be driven. The cages will also be put into No. 2 shaft about that time. The new boilers have been bricked in, and a fire was started under them early in the week to warm things up a little. Work in other parts of the mine seems to be going on satisfactorily.—[Florence Mining News.

MARQUETTE RANGE.

The Bessie Mining Co., at Humboldt, is making daily shipments of ore to the Wisconsin Furnace Co., at Fon du Lac, the encouraging feature of the contract being that it is based upon results obtained from a sample lot of several hundred tons smelted during the month of December. The Bessie is among the new mines of the county, has a large showing of ore which can be mined cheaply. The fact of this cash sale, at a remunerative figure, in a time of the greatest depression in the ore market, is the best possible evidence regarding the value of the property, and the stockholders are accordingly to be congratulated.—[Negaunee Iron Herald.

The Pittsburgh & Lake Superior Iron Co. have doubtless made the discovery of a valuable deposit of ore, from present indications the most valuable of anything yet discovered upon the so-called Cascade range. About one-half mile west of the store directly in line with the Volunteer and Wheat mines, a deposit of pure, hard ore has been struck with a diamond drill at 776 feet from the surface, the hole being on an angle of 77 degrees. At last report the deposit had been penetrated some 30 feet, every inch of the core being perfectly clean ore. Since the sale of the Volunteer the company has expended a considerable amount in exploration, which seems to have been fully justified by the result promised. The ore resembles the best quality of red specular in texture more nearly than any other, though in some respects it is somewhat similar to the finer grades of slate ore. As the drill is set across the formation it is certain a vein of considerable width exists, and drilling will be continued until this width is decided upon.—[Negaunee Iron Herald.

Messrs. William and John Carmichael, of this city, are exploring a tract of land in Republic township, some 15 miles southwest of the Republic mine. The range is distinct from any of the developed ranges of the county, and if their work is attended with success, as present indications seem to promise, a new mining field will be opened. Surface indications and the formation so far as can be judged by series of test pits already sunk, are favorable. An analysis of selected pieces of ore taken from one of the pits gave 62 per cent. of iron. The Carmichaels are expert miners, and will give the section an intelligent examination.—[Negaunee Iron Herald.

The Dexter property, near Clarksburgh, is quite encouraging at present. The management has mined during the past season about 12,000 tons of ore and has already shipped about 10,000 tons. We anticipate that next season's output will be much in excess of the year just past.—[Peninsular Record.

Of the prospects of the non-Bessemer mines of the county for active work in the future, those of the Imperial at Michigamme seem to be the best. The mine is being wrought by the Michigan Land & Iron Co., owners of the fee; is looking exceedingly well, and will be worked to its full capacity so long as there is a margin sufficient to admit the realization of a low royalty. At present a force of about 100 men is employed, which is to be increased somewhat in the near future.—[Negaunee Herald.

At the annual meeting of the stockholders of the Norman Mining Co., it was decided to grant a renewal of the Monongahela Mining Co.'s option, which was granted that company last Spring, or to explore the property with a diamond drill early in the Spring if the Monongahela company does not desire to hold it. The property lies about nine miles northeast of Republic and embraces half a section of land. It has been at various times examined by experts, who have reported the indications of the existence of ore there, similar to that of the Republic mine, to be of the most encouraging character. A range of low hills runs diagonally through the property, near the northeast slope of which numerous test pits and a shaft 30 feet deep have been sunk. These old explorations were abandoned when the present owners purchased the land, two years ago. They propose having the extreme southern part, that covered by the option mentioned, thoroughly explored. The members of the Norman Iron Co., who are all experienced mining men, are confident that ore in workable deposits exists there, and certainly have abundant warrant for their faith in its value. They would have explored the property themselves last Spring, but they had given an option on it to the Monongahela company, and if the latter company does not prosecute the work of testing it, the Norman people are prepared to do it themselves.—[Mining Journal.

The parties interested in the Elba mine, whose faith in that property did not waver when its prospects seemed anything but bright, have cause to felicitate themselves on their pluck and judgment. A deposit of ore of very fine quality has been struck. Work has been in progress on the property for over a year. A shaft 110 feet deep was first sunk, and the one drift was driven in a northeasterly direction, which is now in 150 feet from the main shaft, another, south from the shaft, being started shortly after, the latter being now in 110 feet. No ore in paying quantity was found. About two weeks ago work in the drift to the south was stopped, and a drill was employed to feel for the ore body. The drill cut 50 feet through a slaty formation, after which a body of ore 23 feet in thickness was pierced. Drifting in an oblique direction will soon be started here, in hopes of striking the deposit about the center. On the first of January, twelve men were set at work to start a new drift, in a westerly direction from the old north drift, at a distance of 75 feet from the main shaft. The drill was in about 25 feet when the miners suddenly came upon a fine vein of hard Bessemer ore. The specimens exhibited in town were very fine, but no assay of the ore has yet been made. Now that the true vein has been struck, a much larger force of men will be put at work to develop the mine and get it in readiness to begin shipping in the Spring.—[Mining Journal.

MACHINE MOLDING.

The necessity for some more expeditious mode of molding than by hand has long been felt in foundries, and many more or less successful contrivances have been tried. The molding machines hitherto used have made only one-half of a mold at a time, and many ingenious devices have been adopted to enable one machine to turn out both halves of a mold one after the other; but it has been found that this so generally increases the number of working parts that it complicates the machine to such an extent that in practice two machines are used, one for each half of the mold. This, of course, adds greatly to the cost of machine molding, besides taking up valuable space on the foundry floor. This was felt to be such a drawback that Mr. F. G Leeder, foundry manager of the Singer Manufacturing Co., was induced to try experiments to see if it was not possible to design a machine which should turn out a complete mold at one operation. The result of his experimenting was his patent molding machine, which proved such a success that 41 of these machines are at present at work in their foundry, at Kilbowie. It is said to be the most complete molding machine hitherto made, and one of the simplest. It consists of a couple of hydraulic rams, one within the other. A pattern plate, which is swung on one of the guide columns, and is also free to be raised or lowered on it; this plate, which also serves as a parting plate, has half the pattern projecting from it on either side. Both above and below it are the molding boxes; the lower one is filled with sand, and the pattern plate is then swung into its position for molding, when the upper box, which is balanced by counter weights, is lowered upon it, and then also filled with sand. The outer valve is opened, and the ram raises the lower box up against the pattern plate, and continues to rise until the sand in the upper box comes in contact with and is compressed by the fixed plate at the top of the machine, when the upper half of the mold is made. The inner valve is now opened, and the inner ram presses the sand in the lower box against the under part of the pattern plate, and the lower half of the mold is made. The valves are now closed, and the whole of the moving parts descend, the upper box being first retained by a pawl on the pulley of the counter weight, the pattern plate next, by snugs on the guide columns, while the lower box descends to the full extent of the ram. The pattern plate being now free from both the molds are swung clear, and the upper box lowered on the under one; the molds are thus closed. By raising the inner ram the mold is raised out of the two boxes, and is ready for casting. When running in the metal a loose weight is placed on each mold. This weight can be taken off by the time the second or third mold from it is cast; thus, only three or four weights are required, no matter how many molds there may be.—[Iron and Steel Trades Journal, London.

A Permanent Census Office

At the recent annual meeting of the National Board of Trade the following proposition, offered by J. A. Price, of Scranton, was unanimously adopted:

Resolved, That the National Board of Trade recommend to Congress the revision of the present census and statistical legislation, and the immediate provision for future enumerations, with a view to better service and greater efficiency.

Resolved, That a committe be appointed to draft a bill and present the same to Congress, contemplating permanence of statistical and enumerating officials, and a proper separation of the times in which enumerations of population required by the constitution and the collection of general statistical information is made.

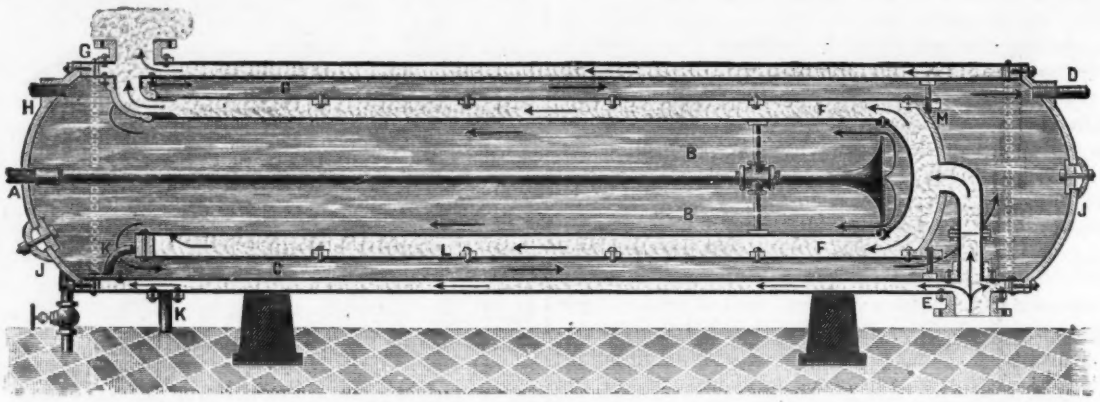
Mr. Price, as chairman of the committee to which this matter was referred, has prepared a form of memorial, for the use of commercial organizations and others, in petitioning Congress to direct the Secretary of the Interior to examine the proposition to establish a permanent census office, as contemplated in the above resolutions, and to report to Congress a plan therefor. It is to be hoped that this will be favorably acted upon by the various bodies representing the business interests of the country, and that the end in view will be reached. Mr. Price writes: "We shall gain the issue beyond a doubt, and the result can be but a lasting good to the country. We shall be ready with a proper Bill for the next Congress."

The Elba Iron Mines.

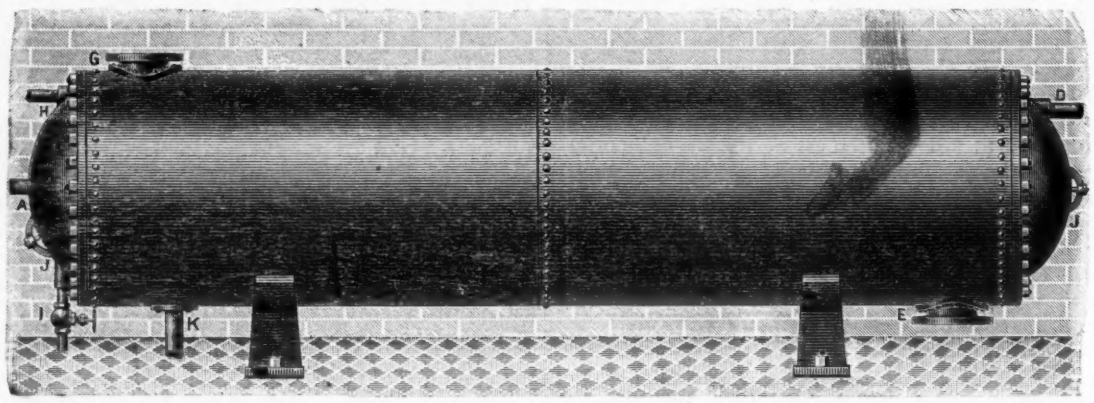
The island of Elba, famous in modern times chiefly because it was the place of Napoleon's exile, was so in ancient days because of its mineral riches. The name of the capital of the island, Ferrajo (iron), and of the channel between it and the coast of Tuscany, Piombino (lead), are witnesses to this. Its earlier distinction it is about to regain, for an English company has been formed with a capital of nearly one million pounds sterling, to work the iron. Before beginning operations the consent of the Italian Government has to be obtained. This has been asked for, and the company expect to receive it without delay, the more especially as it undertakes to supply with ore, before disposing of it otherwise, the Government's great weapon and armament works, at Terni. As is well known, there is a hill in Elba on the east coast which is one mass of iron ore. This hill is nearly three-fourths of a mile in diameter, and from 400 to 500 feet in height.

THE COLLES HEATER (HORIZONTAL STYLE).

In our issue of August 7, 1890, we illustrated the Colles improved steam-jacketed feed-water heater, manufactured E. G. T. Colles & Co., 19 South Canal street, Chicago. In this number we illustrate a sectional and exterior view of a horizontal heater made by the same firm, and known as their "style 6 heater." It is especially adapted to basements, dredges, etc., where there is not sufficient height to put in an upright heater of the desired capacity. Indeed, many prefer this form, owing to its heads being within easy reach for removal, and the ease with which the water chambers are washed out, by simply removing the hand plate in each head for that purpose. By referring to to the letters on the accompanying engravings, the reader will see that the water enters the pipe A, passes slowly backward through the large water chamber B B, so that it remains in contact with the surrounding heating cylinder a long time, and turning around in the form of a thin sheet passes through the annular water chamber C C. This thin sheet of water, already very hot when it enters, quickly absorbs the heat of the steam at each side of it, and passes out to the boilers through the pipe D, heated to within two degrees of the temperature of the surrounding exhaust. The exhaust enters at E, one-half of it passing around between the two outer cylinders, making a steam jacket outside the water; the other half, at the same time, passing into the central steam chamber F F, surrounding the central water chamber, and both pass out at G. It will readily be seen that, as the steam passes over all the heating surfaces at the same time, there is equality of contraction and expansion throughout. H is the scum blow-off, I mud blow-off, J J hand plates at each end, K K drip pipes for condensation from both steam chambers, L



SECTIONAL VIEW.



THE COLLES HEATER (HORIZONTAL STYLE).

trengthening rings, M four bolts at each end of third cylinder, with their heads bearing against, but not attached to, second cylinder. The inside pipe connections are heavy brass. Each cylinder is made of steel. Every heater is tested to 200 lbs. cold-water pressure. No expense is spared in making the Colles heaters first class in every respect. They have more heating surface than most heaters, and no cooling surface. For further particulars address the manufacturers.

Shot and Burnt Iron.

This is a class of iron that foundrymen dislike to have anything to do with, on account of its mixing in and contaminating other irons. Shot iron will sometimes cause hard spots in casting; it also causes them to crack, and very often 500 or 600 would make a 6,000 heat of soft iron so hard that half of the castings would be condemned. Shops that can use nothing but very soft iron in their castings generally have trouble to get rid of shot iron; there are some shops that will not bother with it at all; they will pick out all the iron they can from the cinder, and let the rest go, and it has been a question whether they were not as well off as those who paid help to screen the cinders, and use the shot iron at the expense of making bad castings. Moulders have tried in many ways to use shot iron so as not to spoil good soft iron, and about the best plan is to make a separate heat of it, or melt it at the last of a heat for coarse work, or pour it into "pigs," which can then be used to mix in with good pigs in future heats; but in any form it should be used with caution. Burnt iron, in some respects, is like shot iron, so far as making bad work is concerned. Burnt iron makes more slag than any other iron and causes a cupola to choke quicker. There are degrees in burnt iron, some are worse to deal with than others, but with shot iron it is all about alike. Burnt iron should be used in small quantities only at a time, unless a lot of sash weights are to be made; then a heat can be made of nothing but burnt iron, and the cupola run until the ladles and cupola are all choked, if one desires to do so. In melting ordinary mixtures of iron, such as that used for common castings, there is seldom trouble caused from the different kinds of scrap or pig not giving the quality wanted, when shot or burnt iron is left out, and the melter charges the iron and fuel as it should be done.—[Glasgow Engineer.

IMPORTANT NEW STEEL ENTERPRISE.

Important new steel developments are about to be carried out at the Earl of Dudley's Round Oak Iron & Steel Works, Staffordshire. At present the manufacture of steel is carried on by a Siemens-Martin furnace, turning out 3,000 tons per annum; but a large plant on the Siemens-Martin basic system for the reduction of common ores is about to be laid down, capable of producing 1,000 tons of steel per week. The product is to take the form of ingots, blooms, billets, iron bars, large sections, etc., and the works will be fitted with the most modern machinery alike in the Bessemer converting department and in the rolling mills. The Siemens-Martin furnace at present employed differs from the ordinary Siemens type, in having regenerators fixed over, instead of under or at the sides of the furnace. The advantages obtained from this new steel furnace are: freedom from the pernicious influence of water or damp, from the bursting and choking the "checkers," from inconvenience in the blocks giving way, and from the ease with which the "checkers" can be watched and got at. The natural objection to this system would be that as gases ascend, there would be a difficulty in drawing them down into the furnace. But this is not found to be the case in practice, the explanation being that, as the escaping flame is so very much hotter than the incoming gas and air, the draught outwards quite overcomes this difficulty. By analysis, the new steel is shown to be identical with charcoal iron, except that it contains a little manganese.

The ingots are cast in sizes suitable for rolling off direct into finished bars, except for special sizes where blooming down may be necessary. The system of fuel supply upon which the new Siemens-Martin basic steel works is to be laid out, is of the most economical description. Instead of large coal being bought for the furnaces, and slack for the firing boilers, slack is to be used, it being previously screened by two revolving screens, so arranged, by means of gradients, as to dispense with horse work. By means of these screens, which will screen 500 tons per day, the slack will be divided into the sizes and proportions requisite for the various purposes for which it is required. Large coal will be sent to the "grate" heating furnaces, screenings or kibbles to the puddling and gas furnaces, and the fine siftings to the boilers with mechanical stokers attached. Thus slack only will burnt in the works, *i. e*, the cheapest possible fuel. One essential feature in the composition of weldable steel is absence from sulphur. This quality the Staffordshire thick coal is noted for.—[Colliery Guardian, London.

Crushed Steel for Cutting.

Crushed steel is said to be coming into use for cutting stone. It appears to be made by quenching very high carbon steel in cold water from an excessively high temperature, such as would overheat steel for most purposes. This renders it not only hard, but rather brittle, so that it is possible to pulverize it. It is then crushed in a stamp mill, and sifted closely to size.

THE Scottish Pig Iron Association has resolved to restrict the numbers of its members, and to admit no further applicants until vacancies occur. It has also been decided that in future no one shall be admitted to the pig iron "ring" who has not had experience of business in the iron trade.

GAS VERSUS STEAM.

Great strides have been made since the time that Watt discovered the great latent power in steam, and the crude engines of the first half of this century have been replaced by automatic cut-off engines, as perfect in design and workmanship as it is possible to construct with the latest improved machinery. But still the world advances, and instead of coal being used as a fuel to obtain steam, devices are employed to burn either crude oil or kerosene. Then automatic appliances are attached to control the fire, so that when the steam reaches a certain pressure, the fire is shut down and kept at a mean pressure, and the water supply to the boiler is also controlled by similar devices. Here, then, one would think that perfection had been reached in this line, but not so; another step has been taken, and we do away with the boiler altogether, and are not dependent on steam for our motive force, but use instead gas or vapor. Indeed, the day is not far distant when coal will only be used as an indirect factor in making gas for heat, light and motive power. That this is the case is illustrated by the large number of different gas engines now in use. These, while differing somewhat in their outward construction, are essentially the same in principle, and admit a charge of gas into the cylinder, which is exploded by a flame-igniting device.

However, during the past two years an improved type of gas engine has been placed on the market, known as the Regan vapor engine, and used very extensively in California, where it was invented. This engine is now manufactured by Thomas Kane & Co., Chicago, Ill. No fire is used about this engine, but the charge is ignited in the cylinder by a spark from an ordinary wet or dry battery, as described below. It is an engine that can be placed in a house, store or barn with perfect safety—requiring no fire, self-feeding, safe—capable of being started by a boy and then left to care for itself. While gas can be used as a fuel, the Regan engine runs as well with gasoline, the process of which is as follows, and illustrated in engraving of upright engine, showing carburetor and small battery complete:

It is operated by means of vapor, drawn into the cylinder by the suction of the piston, and ignited by an electric spark, as follows: The carburetor, as shown in the illustration, contains a small quantity of gasoline; this carburetor is connected with the engine by a pipe, as shown. At each revolution of the fly-wheel, a current of cool air is drawn through the carburetor and into the cylinder. In passing through the carburetor, it vaporizes a quantity of the gasoline; this, when mixed with more air drawn through the pipe and air-valve, forms the charge, which, upon combustion, develops the power. This charge, as already stated, is drawn into the cylinder as the piston is drawn out by the crank and fly-wheel; on the return stroke, it is compressed in the head of the cylinder, and just before the piston arrives at its highest point, or "upper dead center," a shoulder, or point projecting from it (which is an electrode) comes in contact with a flexible piece (also an electrode), the two comprising the poles of the small battery, thus completing an electric circuit, which is broken just as the piston has passed its center and commences to descend. At the instant the electrode separates, the spark is emitted, firing the charge. On every other stroke of the piston, this is repeated automatically, save when the supply was "cut off" by he governor, which not only controls the engine perfectly, but at the same time "cuts off" the supply of gas, so that when less power is being used, proportionately less gas is consumed. The Regan vapor engine is built both upright and horizontal, from ½ horse-power upwards, both for stationary and marine purposes.

A Notable Instance of Power Transmission in Tunneling.

Electricity is performing a very important part in the work of building the great Trans-Andine Railway, with which every newspaper and magazine reader must now be familiar. On the section of the line between Santa Rosa, Chili, and Mendoza, Argentine Republic, the range of the Andes is traversed by a series of tunnels through very hard rock. The drilling machines for opening the highest of these tunnels are 10,500 feet above the sea level, and cannot be worked by steam, owing to the enormous cost of transporting fuel. Less than two miles distant, however, there is a waterfall of nearly 600 feet. This is being used to work twelve Girard turbines, of 80 horse-power each. Each turbine will work a dynamo of 400 volts and 135 amperes, and the current thus generated will be carried by wire to the tunnel heading, and then reconverted into mechanical power by ten motors, of 60 horse-power each.

THE QUALITY OF AMERICAN FILES.

Unsparing abuse has been heaped upon the American file by Henry Binsse, proprietor of the Newark (N J) Machine Tool Works, in a communication printed in the New York *Evening Post*, of December 10. Mr. Binsse, though a builder of machinery for a number of years, confesses to having discovered only within a year or so the wonderful inferiority of the American file, and he expresses the opinion that this worthless tool remains in use in this country to the exclusion of foreign goods, only because the facts are not more generally known. The story of his discovery of the truth is thus told by him:

"A die of hardened steel was brought to my works to be filed smooth. The work was begun at seven in the morning. Presently my foreman came to ask for a new file, the first one having been worn smooth by the die. After an hour or so, he reported again that no progress was being made. This called my attention to the matter, and I found that not one American file in my shop—and I had the three best makes—not one of these files could smooth that die. By this time it was noon and three files had been ruined. The die was needed for the following day. I asked my foreman if there was no file which could do the work.

"'Oh, yes,' he said, very calmly, 'I think an English or Swiss file will do it.'

"By one o'clock I had a Swiss file; and, before six, the die was smooth, and the Swiss file enjoyed a life of usefulness for six months afterwards."

Led by this experience to look into the question carefully, Mr. Binsse satisfied himself that while the coarse American files, from 10 inches in length upward, will stand comparison with foreign makes, the rest of the list cannot be compared at all with similar English, French or Swiss files. This difference, he finds, is especially great in the so-called Stubs files, and a workman using a Stubs or a Grobet file can perform at least double as much work as when using an American file of the same size and cut. Mr. Binsse then asks why, in view of these facts, any American files are used at all? His question he answers himself by stating that the American file-makers, finding their smaller sizes "simply trash," secured a prohibitory tariff rate upon imported files, and soon had the market practically in their own hands. He asserts that the profit on the foreign article is much smaller than on the American, so that merchants prefer to sell the latter, and thus, "little by little, we have accustomed ourselves to the inferior article, and a decreased output." Mr. Binsse is convinced that every machinist, locksmith, die-maker, tool-maker, instrument maker and watch-maker, using files of the inferior American make, finds his product thereby diminished about one-half, and his profits correspondingly lessened. He thinks that perhaps "some American file-maker will see fit to deny these facts," but he is anxious to see a test made, feeling that the result will support his statements.—[Hardware.

Motor versus Shafting.

There is one problem in factory economics which the owners of mills can study to their advantage, and that is "The electric motor versus shafting." The advantages in the use of electric motors are now generally admitted, but there are still opportunities to use them with profit which should not be neglected. They are found in mill and factory construction. A large mill in which all the power is transmitted by means of belts and shafting is a costly one to operate, as a certain load has to be carried at all times irrespective of the number of machines actually working. This means a constant expenditure of energy for which there is no return whatever; and, moreover, there is a constant depreciation on the belts and shafting used for transmission simply, which is by no means inconsiderable. This expense of constant load increases where intermittent work is done. For instance, it may be unnecessary to run the shafting on an entire floor, but the intermediate shafting has to be kept in operation nevertheless. This can be obviated in many cases by the use of the electric motor, for it acts as a governor on the engine, any decrease in the number of machines requiring less energy from the motor which requires less current from the dynamo, and this means less coal under the boilers. In the transmission of power, practice has undeniably proved that electricity is the most economical agent, even for limited distances.—[American Miller.

A Power Steam Crane.

A powerful steam crane, recently built by a firm in Scotland, is to be used in coaling steamers by a decidedly novel method. Ordinary railway coal cars, with their full load, are run upon a large table near the crane. The table, with the loaded car securely fastened on it, is then hoisted to the wharf, and is lowered directly over the hatchway of the ship. By an ingenious arrangement the car is tilted, and its contents emptied into the hold. With this apparatus the work of loading vessels is greatly facilitated, it being possible with it to load 1,000 tons of coal in ten hours.

Mileage Tickets on the Pennsylvania Lines.

On and after January 20th, 1891, individual and non-transferable one thousand mile tickets, good over all divisions of the Pennsylvania System, west of Pittsburgh, will be sold at rate of two cents per mile, or $20 each, by line agents at principal points. All forms of mileage tickets heretofore issued for the Pennsylvania lines—still unused and unexpired as to time limit—will be honored on and after above date, on all roads operated by either the Pennsylvania Co. or the Pittsburgh, Cincinnati, Chicago & St. Louis Railway Co., and only one thousand mile tickets will be thereafter sold. E. A. Ford, General Passenger Agent.

PROPOSED ADDITIONAL DUTY ON SPANISH ORE.

Most readers are doubtless aware that the Spanish customs tariffs are being revised, and new duties, or rates of duties, levied. Various statements have already appeared in your own and other papers, giving some details of the heavy duties to be put on imports here. At a meeting of the Government Tariff Commission, it was approved, by 13 votes against eight, to recommend the Government to put an export duty of five per cent. *ad valorem* on all iron and copper ores sent out of Spain, and it is to prevent this heavy new tax becoming law that steps are being taken by parties interested in the prosperity of their trades.

The Miners' Club, in Bilboa (composed of all the important mine owners, merchants and exporters), has taken the question up, and it is receiving the aid and help of all those who are in any position to help in the movement. There already exists a one per cent. tax on all minerals extracted from iron ore mines in the county, which tax forms part of the Government revenue. It is based on the value of the ore at the mine's mouth. This additional five per cent. tax is to be placed on exported ore, and there are many considerations which could be urged against such an oppressive charge. It naturally appears to the inhabitants here that the district is to pay the penalty for its industrious habits and consequent prosperity; and the question arises as to the use to which the large sums of money will be put, which will be drained out of this province, to benefit others, and it would seem that the consumer will eventually suffer by the impost, which will inevitably increase the price of ore, and thus accentuate the interest which all in iron-making districts must feel in the matter. The Government, in taxing the output from the mines, is making an economical error, inasmuch as they are not taxing income, but the mine owners' capital, as every ton which is worked by him reduces what he has to fall back upon, and he thus simply is realizing in money what he had before only in kind. A mistake is made by advocates of this measure, when advising the taxing of exported mineral, on the ground that the great bulk of the ore trade is in hands of foreigners. It would rather seem the policy of a country like Spain to attract the foreigner with his capital than to drive him away by putting such prohibitive taxes upon his work, by making the gaining of a profit uncertain.

It is evident that the Government or its advisers regard the Spanish ore industries as indispensable to the home iron industries, or, if not indispensable, at least necessary to such an extent as to make a tax of five per cent. on value a payable duty. Doubtless, Spain is rich in minerals, and occupies, geographically, a favorable position for their export; but she should not, for that reason, run the risk of so checking their development by heavy taxes as to damage their own interests; and it is not to be forgotten that there exist huge ore deposits in Sweden and elsewhere, which would soon be worked to the detriment of Spain, if she, by folly, made that easy by increasing competition and putting up prices. And, further, the process of steel manufacture from phosphoric ores is in the way of completion, and when the cost of such system is brought down to the level of steel for which hematite Spanish ore is smelted, then Bilbao will have other large fields to compete with and to contend with in keeping up her mineral exports. The Free Trader finds it difficult to understand heavy protective duties like the present. The total ore export from Bilbao river is about 4,000,000 tons annually, and the duty of five per cent. on value of ore would, roughly, be about 5d. per ton—thus producing a sum of £80,000, mostly to be paid by English manufacturers.—[Newcastle (Eng.) Chronicle.

IMPORTAT EXPERIMENTS WITH ALUMINUM STEEL.

An important experiment, by which it is intended to demonstrate the practicability of making aluminum steel, is now in progress at the Carbon Iron Co.'s Works, on Thirty-second street. The company has recently received a valuable contract for steel from the Government, the material, which is known as protective deck steel, to be used in the construction of cruisers. It has long been regarded as a fact that aluminum improves the quality of steel, and the company has started out to discover to what extent this improvement can be carried.

The first experiment was made last week. The work was done by the open-hearth process until the point where the liquid metal is poured from the ladle into the molds was reached. Here, instead of using a top cast, a bottom cast was substitued; and, instead of pouring the metal direct into each mold separately, it was poured into a "runner," filling simultaneously a whole group of twelve molds. The experiment worked all right until a quantity of aluminum was thrown into one of the molds, when the whole mass of metal, which was rapidly filling up the molds and was in a state of ebullition, came in contact with the aluminum, its progress was arrested, and the liquid steel set, or became solid. This, of course, did not produce the results aimed at, and another experiment was made, with greater success. The aluminum was added earlier in the subsequent test, and an immediate and thorough union of both substances resulted.

Mr. H. W. Lash, Superintendent of the Carbon Iron Co., was seen at the works yesterday afternoon. At first he was inclined to be non-committal in regard to the matter, saying that the experiments had not been carried through yet, and he was satisfied that all the results attainable by the process he had followed had not yet been reached. But he said they had gone far enough to demonstrate beyond a doubt that aluminum steel is a success. "What we want to do," Mr. Lash continued, "is to improve the quality of steel. It has been accepted for some time that about one-tenth of one per cent. of aluminum added to the steel increases its strength and ductility. We have gone farther. We have used from two-tenths to three-tenths per cent., and find it increases the quality in proportion. We use the aluminum manufactured by the Pittsburgh Reduction Co., and I am satisfied we can raise the grade of steel, and while we are only beginning to do work for the Government, it will not be long until we will get larger contracts. The Government is very particular about the quality of steel, and will always place contracts where the best material can be furnished. What we are aiming at is to harden our steel with carbons and toughen it by the use of the aluminum, and I think before long we will have the process perfected, and can produce astonishing results."—[Pittsburgh Dispatch, January 21.

A Great Sale of Boilers.

We are in receipt of the following report of the sale of Babcock & Wilcox boilers in the Pittsburgh district for the year 1890:

Name.	H. P.	Name.	H. P.
Latrobe Steel Works	832	Wilmerding Club	45
Pittsburgh Reduction Co	624	Heinesworth Steel Co	500
Harbison & Walker	312	Wheeling Steel Works	500
H. J. Heinz & Co	208	Pittsburgh & Birmingham Traction Co	1,000
Woodland Fire Brick Co	92	Monongahela Electric Light Co	60
Charleroi Plate Glass Co	2 000	North American Construction Co	208
Jones & Laughlins	2,500	Tyler Tube & Pipe Co	250
Braddock Wire Co	500	Vandegrift Building	184
Isabella Furnaces	500	Buffalo Traction Co	1,000
Dixmont Insane Asylum	468	Oliver & Roberts Wire Co	1,000
Cleveland Cable Railway Co	1,125	Mabel Furnaces	750
George Westinghouse, Jr	208	Pittsburgh Wire Co	1,000
Westinghouse Machine Co	480	Pittsburgh Plate Glass Co	3,500
Armstrong Bro. & Co	416	Moorhead Bro. & Co	146
St. Louis Wire Mill Co	500	Cambria Iron Co	7,000
Bindley Hardware Co	30	Louisville Gas Light Co	2,100

This great amount of business, which far exceeded the most sanguine expectations of the Pittsburgh office of the Babcock & Wilcox Co., has led the concern to decide upon still further extending their business in this district, and they have therefore opened an office in Room 412, Perry-Payne Building, Cleveland, with a view of getting a share of the patronage of the great manufacturing concerns in Northeastern Ohio and Northwestern Pennsylvania, which could not be well handled from Pittsburgh. The Cleveland office will be in charge of Mr. G. A. Humphreys, who was formerly connected with the Heine Boiler Co., of St. Louis, Mo.

The Growing Use of Wrenches.

The number of wrenches sold in the United States, though already large, is constantly increasing. Large dealers in New York and other cities frequently order 1,000 dozen at a time, and a very ordinary order is 100 dozen. Every portion of the country takes them largely, and no particular style seems to sell better than another. A buyer from Germany was in New York last month, and gave an order for a sample wrench of every style and size that could be gathered here. These are to be sent to Germany, and an effort is to be made to introduce, as far as practicable, a full line of American wrenches into that country. Notwithstanding the large demand for these goods, the tendency in prices seems to be downward. Wrenches that were selling two years ago at 35 per cent. discount, are now quoted at 50 and 5 per cent. The trade invariably demands an excellent article, and a poor wrench is, as a rule, unsalable. Inventors, within the past few years, have sometimes been so unfortunate as to place themselves in the hands of manufacturers, who in their endeavors to place a cheap article on the market have sacrificed quality only to reap what seems to be an inevitable result, failure. Not long ago one manufacturer lost $30,000 in such an attempt. It was with the greatest difficulty that he could sell a second lot to the same party, and the third order never came. The export trade in wrenches is constantly increasing, the American article meeting with high favor in many countries abroad.—[Hardware.

Cleveland Boilers for the Sandwich Islands.

As an evidence of the world-wide reputation which the lake industries now obtain, we note the placing of an order with the Cleveland Ship-building Co. for two boilers 11 feet in diameter by 10 feet six inches in length for the ocean steamship Kinau now lying at Honolulu, Sandwich Islands. On referring to the classification lists of United States tonnage we find that the Kinau is owned by the Wilder S. S. Co., built by Wm. Cramp & Sons Co., at Philadelphia, Pa., in 1883, and now hails from Honolulu, Sandwich Islands. We leave our readers to judge of the celebrity of the lake industries when orders are received from a distance of nearly 5,000 miles. The boilers will be completed at the boiler shop department of the Cleveland Ship-building Co., then taken apart and shipped in plate form with rivets, flues, etc., all complete for putting together in the steamer. The Continental Iron Works, of Brooklyn, N. Y. furnish the corrugated flues for these boilers.—[Marine Record.

American Hardware Abroad.

Statistics derived from trustworthy reports show that of the hardware and agricultural implements exported from New York, in a single fortnight, more than one-half were consigned to parties in Central America, Mexico and South America. Dividing the markets for these products into three districts, statistics indicate very fully the amounts shipped to each, as follows:

	English Speaking.	Central Europe.	South America.
Hardware	$43,602	$26,5·8	$ 4,344
Cutlery	,771	741	11,825
Agricultural implements	14,932	3,045	18,175
Total	$60,305	$30,374	$34,744

The inference is that South America affords a fine field for the exportation of those classes of goods.—[The American Exporter.

Scale is Expensive.

It is estimated that the presence of $\frac{1}{16}$ inch of scale causes a loss of 13 per cent. of fuel; ¼ inch of scale causes a loss of 38 per cent. of fuel; ½ inch of scale causes a loss of 60 per cent. of fuel. The amount expended in consequence of loss of fuel and extra repairs on a locomotive in the Middle and Western States has been carefully estimated at about $750 per annum, and for the same power in stationary boilers at about a similar amount. All this extra expenditure is due to incrustation.

SOURCES OF SUPPLY FOR NICKEL STEEL.

As the question of the nickel supply of the world is now being eagerly discussed, in view of the prospective demand for nickel steel, the following, from the *Australian Mining Standard* of November 19, (just at hand) will be read with interest:

The prospects of owners of nickel mines are much brighter than they were when we last wrote of this metal, in connection with the reported discovery of a deposit in the north of South Australia. At that time, it may be remembered, we said that, having got the metal, the difficulty was to find a market for it, because the French Nickel Co., *alias* the Rothschilds, so jealously guarded its monopoly of the metal that even Germany, "the enemy across the Rhine," had to go to France in order to supply its considerable wants. But there may arise circumstances which are capable of defeating even the mighty Rothschilds. The French Nickel Co., draws most, in fact, nearly all of its supplies from New Caledonia, where it has specially assigned to it a large number of convicts; but, despite this advantage, latest reports state that the rival producers of nickel on that island—for the company does not control all the mines—are making more satisfactory progress, despite the previous total failure of the great English metal house of Vivian, to make headway against Rothschild competition.

But this item, however gratifying to owners of nickel mines, is of compartively little importance when compared with another which comes from the United States. Recent tests have been made there, at the naval academy, at Annapolis, on the plates used by different countries for armored battle ships; and these tests resulted in favor of the nickel steel plate as used in the French Navy. The Cammel plate, used in the British Navy, was pronounced by the Ordnance experts to be practically useless when exposed to the same projectile as the nickel plate, which was invulnerable under the same fire. The results of the ordnance experiments were so conclusive that an appropriation of $1,000,000 for the purchase of nickel was made in Congress without debate, the object being to secure the metal for immediate use in the armor of the war ships now in course of construction.

The results of the experiments, which were carried out with great care, are certainly astonishing. That they will have effect not only in the United States, but also in the countries of Europe and elsewhere, and not only in the manufacture of armor plates but also of machine parts, where a high breaking strain and toughness are desirable, is certain. Against this increased and wider demand it is highly questionable whether the Rothschild monopoly will be able to stand. Certainly it will not be in a position to control the American market. One important fact mentioned in our American notes this week must not be lost sight of; the United States have no nickel mines, but are dependent for their supply upon Canada, where a new mine was recently opened out. But so far as we can judge, this property, now thought of immense importance, is not to be compared with even those Caledonian properties, which are not under Rothschild control. Some of these mines are partly held by Australians; and we may hope that English buyers, and especially the Imperial Government, which must shortly act upon the results of the Annapolis tests, will deal with these producers rather than with a foreign prison-labor aided monopolistic ring, which, in the past, has done so little justice to consumers.

On the mainland of Australia practically no prospecting for nickel has been done. Indeed, few prospectors seem to know the ore when shown them. This is not altogether surprising, since nickel ore has many and diverse forms, colors and general characteristics. Even in New Caledonia hundreds of tons of good ore was for many years thrown away by men moderately skilled in nickel mining, who believed it to be useless. Generally speaking, nickel ore is more like copper ore than any other. And it was from a circumstance arising out of this similarity in appearance that it got its name—nickel. "Nickel" is the German synonym for "a worthless person." Miners, being disappointed in finding that what they thought from its color was ore of copper did not contain any of that metal, flung it away in contempt, calling it *kupfer-nickel*. The specific gravity of the metal when hamered is 8.82, and it is attracted by the magnet. In view of the increased demand which is bound to arise, and the more open market which may fairly be expected, it will be well worth the prospectors' while to look carefully into ores which they may at first be disposed to throw aside contemptuously, as others did before them.

STEEL-MAKING IN COLORADO.

At a recent meeting of the Denver Manufacturers' Exchange, J. W. Nesmith, President of the Colorado Iron Works, delivered an address, from which the following extract is taken:

Furnaces and mills for the production of pig iron, bar iron, beams, sheets and plates of iron and steel are of importance to our city in proportion as they make possible by the comparatively low cost of such material the profitable manufacture of all or most important articles, machinery and appliances in the production of which iron and steel material are the principal constituents and as to importance of such manufactories. Suppose car works here on a paying basis, then on each 1,000-car contract which they would execute $500,000 is distributed in our community by that concern, besides that expended here by the steel and iron company in producing the iron used in the manufacture of the cars. Thousand-car contracts are not very uncommon, and when we build cars as cheaply here as do Eastern builders, then we may have some such and many lesser every year from our tributary 35,000 miles of railroad, and so that industry alone would distribute its millions every year among us. Like results and of parallel importance may be attained in many other branches if iron and steel are sold in our market at about average prices of such material in the Middle and Western States.

This important point must be kept prominently in view, and no proposition for iron and steel works entertained or encouraged which does not contemplate the furnishing of iron and steel over a wide range of territory to general manufacturers at such cost as will enable them to compete in the market with their products and commodities, for the manufactories that come after and are made possible by the low cost production of iron and steel are of more importance to the community and will keep more money in circulation than would the steel and iron works without such following manufactories.

It is believed that a move is already being made in this direction, for it is reported on good authority that the Colorado Coal & Iron Co.'s iron and steel works, at Pueblo, are to be thoroughly overhauled, and a reorganization of appliances and equipment is to be made. Two new smelting furnaces are to be built, which will make four in all, which will give a capacity, it is said, of 500 tons per day of pig iron. The old three-ton converters are to be replaced by larger ones. Metal is to be taken direct from the furnaces to the converters and blown into steel without remelting. A soaking pit is to be provided for producing the proper uniform heat of ingots throughout their whole dimensions before their passage through the breaking-down rolls. Pueblo, the State at large and the Colorado Coal & Iron Co. are to be congratulated on this important improvement, if it is consummated.

Five hundred tons of pig iron per day, then, may hereafter be the Colorado Coal & Iron Co.'s producing capacity. This would equal 175,000 tons in a year of 350 days' run. As the per capita consumption of pig iron in the United States averages something like one ton for each seven persons, and with an output as above estimated, the Pueblo mills could thus supply iron and steel material to 1,225,000 people, or less than one-sixth of the population west of the Missouri River. As there are 8,000,000 people west of the Missouri, we have thus 6,750,000 unprovided for and which we should supply, assuming, of course, that we can produce iron and steel at lower cost than can any city east of the Missouri River, which we can surely do.

There appears to be room, then, for a pretty extensive concern, and it does not appear that there need be the least friction or unhealthy competition between steel works in Colorado until the production surpasses by many times that already provided for in the State, so long as they adhere rigidly to the proposition, by producing and selling here at Chicago and Pittsburgh cost and prices, and if we want the smoke cloud which hovers over our city increased to many times its present dimensions, it is on these lines we must proceed.

Destruction of a Historic Iron Foundry.

A dispatch from Morristown, N. J., January 22, says: One of the most historical spots of New Jersey was, this afternoon, destroyed by a freshet that has inundated the lower portion of this city, and this evening rendered homeless scores of poor people. Two miles above this city is Speedwell Lake, a body of water over four miles in circumference. On the bank of this lake is an iron foundry, formerly owned by Stephen Vail, the builder of the first steam vessel to cross the Atlantic. In this building the first telegraph instrument invented by Morse was stationed, when the initial message over a telegraph wire was sent to Boston in 1835.

The building is an antiquated wooden structure, and during the past five years many New York capitalists endeavored to purchase it for its historical associations. About four o'clock this afternoon the residents in the vicinity of the building were notified by a loud noise that the ice on the lake was breaking up, and that the dam was in danger. Tons of water swept over the dam, and every minute crept nearer the Vail building, but soon a break was noticed in the dam, and hardly before the spectators could reach a place of safety the dam gave way with a thunderous noise, and carried away with it a large portion of the old building.

A Lake Ship-yard Surpasses Clyde and Tyne Yards.

The *Marine Engineer*, London, in reviewing the work of the ship yards for the past year, has the following to say: "The Tyne Shipbuilding Co. have increased their output this year by 2,469 tons, their total for the current twelve months being 18,016 tons. This, it may be remarked, is a very creditable twelve months' output for a yard with only four building berths, and with one exception it is larger than the output of any leading Clyde yard, as far as can be gathered from the returns published." This is interesting, for it will be noticed that this Tyne yard has four stocks, the same number as have the Globe Iron Works Co., Cleveland, which put forth 20,230 tons, as against the 18,016 tons of the English yard, during the current twelve months. The Globe Co. built their own engines and furnished from their works the larger part of the equipment. With one exception, the *Marine Engineer* says, the output of the Tyne yard exceeded the output of any leading Clyde yard, so we have a lake shipbuilding company, standing shoulder to shoulder with the largest yard on the Clyde, where steel ships are said to grow as plentiful as water lilies on the banks of a river.—[Marine Review.

A "Substitute" for Aluminum.

Here is a mere hint of what may turn out to be a big thing. It comes by way of the *American Manufacturer*, from Wolverhampton, Eng. Says this Wolverhampton special: "The chief news is of what is said to be a new substitute for aluminum. It is stated that this substitute will be of value to iron and steel masters, but more especially to iron founders. The invention is said to open up a possibility of the employment of aluminum on a large scale, inasmuch as the expensive commercial aluminum will no longer be used, but a cheap flux very rich in alumina and easy of reduction in a blast furnace. This new flux when brought into a fusing state in the presence of molten iron or steel gives off metallic aluminum gases or vapors having a strong affinity for the metal, and the iron in this state absorbs these gases in *tatuo nascendi*, thus forming not a mere mechanical alloy, as in the old process, but a new metallic compound of great tenacity."

INDUSTRIAL SUMMARY.

New Enterprises:—

E. M. Cross, of Berlin, N. H., is building a foundry in connection with his machine shop.

Seymour Schultz Galvanized Iron Cornice Co. has been incorporated at St. Louis; capital, $6,000.

It is reported that big iron works will be located at Christy, Pa, near McKeesport, Pa.

R. J. Crous will build a $12,000 foundry at Greenwood avenue and Seventy-second street, Chicago.

The Curtis Hardware Co. is a new incorporated concern at Wellington, Kan, with a capital stock of $30,000.

The St. Joseph Bridge & Boiler Works have been incorporated at St. Joseph, Mo., with a capital stock of $42,000.

Houston, Stanwood & Gamble, of Cincinnati, O, have, it is stated, purchased, for $18,000, a site for their engine works, at Covington, Ky.

A company has been organized at Lincoln, Ill., with $150,000 capital, to manufacture the drill recently made at Havana; F. C. Orton is interested.

The manufacturer of a storage battery for street cars is negotiating for the old works of the Brayton Petroleum Engine Co., at East Bridgewater, Mass.

The Druggist's Scale Co. has been incorporated at Chicago, Ill., to manufacture druggists' scales, by H. R. Smiley, C. R. Sammon and J. T. Richards; capital stock, $25,000.

Hydropneumatic Power Co. has been incorporated at Chicago, capital stock, $12,000,000; to manufacture machines: incorporators, Isaac T. Dyer, Ricord O. Burke, John R. Coffey.

The Safety Barb Wire Co., of Toronto, Can., are desirous of starting a plant in Denver, to cost $250,000. The manager is Mr. E A. Beers, who is in correspondence with Denver parties.

A new nail company with a capital stock of $100,000 has been organized at Seattle, Wash., by George Gray, formerly foreman in the works of the Pacific Iron & Nail Co., at Oakland, Cal.

The Patten Self-Oiling Journal Co., with a capital stock of $100,000, have been incorporated at Baltimore, Md., by J. S. Patten, Edwin Higgins, J. A. Pierce and others, and will establish axle works.

The Herrick Manfacturing Co. have been incorporated at Syracuse, N. Y., by George S. Herrick and associates, with a capital stock of $25,000, for the purpose of manufacturing feed regulators for pumps connected with boilers, and other appurtenances connected with steam pumps.

The Waynesboro Stove Co., lately formed by J. W. Loth, of Richmond, and others to establish stove works at Waynesboro, Va., has completed its organization with T. H. Antrim, President; J. T. Smith, Vice-president, and I. K. Moran, Secretary. The capital stock is to be not less than $30,000 nor more than $100,000.

Barbour, Stockwell & Co., of Cambridge, Mass., manufacturers of street railway supplies, have in course of erection a machine shop, three stories in height and 150x52 feet in size, a foundry 175x75 feet, having a monitor roof, and a pattern shop 125x52 feet. The different departments will be equipped with the most improved machinery, and the old works of the company abandoned.

The Maxton Manufacturing Co., recently reported as incorporated at Maxton, N. C., for the purpose of establishing an iron foundry and manufacturing machinery, have perfected a final organization by the election of the following officers: John C. McCaskill, President; J. C. Parish, Vice-president, with the following as directors: John B. McLaurin, M. McNail, T. B. Pace, T. J. Elenore. The company have a paid capital stock of $50,000. A portion of the machinery has been purchased and work on the buildings is progressing.

A new manufacturing company, to be known as the Austin, Soule & Bennett Co., has been organized in Milwaukee. It is to engage extensively, at Layton Park, in the manufacture of all kinds of tacks and small wire nails, and will succeed to the business of Austin & Soule, greatly enlarging the plant, putting in new machinery, etc. The officers are: Charles Bleyer, of St. Louis, President; G. F. Soule, Milwaukee, Vice-president; E. P. Bennett, of Chicago, Secretary and General Manager. The capital stock of the new company is $25,000.

The old-fashioned way of sprinkling streets, will in all probability be superseded by a sprinkler made at South Bend, Ind., in which the radical departure consists of throwing water directly downward, and not up and out backward as heretofore. This makes it impossible to throw water on pedestrians that may be close to the rear of the wagon when the water is thrown on. The water is thrown 22 feet wide and more evenly distributed than heretofore. Much or little water can be thrown, to suit the requirements of the street. The Miller-Knoblock Wagon Co. are erecting a large new factory in which to build the sprinklers on a large scale.

Enlargements, Additions, Removals, etc.:—

The Bates Machine Co., of Joliet, Ill., are building a large pattern shop on the grounds occupied by their works.

W. H. Moffett & Co., Rushville, Ind., machinists and dealers in brass goods, iron pipe, natural gas fixtures, etc., will increase their facilities by the erection of new buildings.

The Specialty Manufacturing Co., Limited, of Allegheny, Pa., has just doubled its productive capacity by an addition 40x100 feet to the machine department, for which has been provided a 100-inch planer, and a 50 inch lathe.

The Hoopes & Townsend Co., bolts and nuts, Philadelphia, Pa., and Wilmington, Del., have purchased the property on Buttonwood street, lately occupied by the Moore & White Co. This property fronts 40 feet on Buttonwood street and extends back to Hamilton street. This addition gives the company a frontage of 512 feet on Buttonwood street, but they are still cramped for room.

The Crucible Iron & Steel Works, East St. Louis, Ill, will nearly double their capacity by the erection of a new foundry 100x64 feet. The improvements will cost $100,000.

It is probable that in the near future the Chicago Tire & Spring Co., of Melrose, Ill., which employs less than 100 men, will be so enlarged as to furnish employment to 500 persons.

The Crane Co., of Chicago, are making arrangements to rebuild the pipe mill recently burned. It will be located on the old site, on the corner of Fulton and Desplaines streets. Three buildings will be erected.

The Watt Mining Car Wheel Co., of Barnesville, O., will, the coming Spring, erect a new plant for their foundry and machine works. The buildings will be of iron, and will materially increase the capacity of the company.

Glover Bros., iron founders, at Frankford, Pa., have broken ground for a new plant, which will give employment to about 100 hands. They are to erect at once a brick building 52x120 feet, which will be divided into four large rooms, with a clearance of 16 feet from floor to beam. There will be a tumbling room, a finishing shop, a machine shop 30 feet square, and a two-story pattern loft 20x50 feet. The latest improved machinery is to be introduced.

There is a possibility, says the *Iron Age*, that the Phœnix Iron Works, of Cleveland, will be moved to Youngstown, O. Considerable correspondence has already passed between Mr. Thompson and some Youngstown parties looking to the removal of the works, but as yet nothing definite has been agreed upon. In all probability the matter will be decided within the next 60 days. The product of the plant consists of a general line of steam engines and cranes, the latter being a specialty of the concern.

General Industrial Notes:—

The Laidlaw & Dunn Co., of Cincinnati, O., has received the contract for complete water works plant, at Carthage, O.

The Tyler Tube & Pipe Works, at Washington, Pa., have started up again, and are now expected to remain in constant operation.

The Richmond Locomotive & Machine Works, at Richmond, were partially destroyed by fire, January 14, with a loss of $125,000.

It is said an effort will be made to preserve, as a relic, what remains of the old dismantled furnace in Karthaus township, Pa., where coke iron was first successfully made, in 1835.

C. H. Brown & Co., of Fitchburg, Mass., are now at work on the largest pulley ever made in that place. It is 24 feet in diameter, five feet six inches face, and weighs 95,000 pounds.

The boiler shop and the machine shop of the Roberts Iron Works Co., Cambridgeport, Mass., were destroyed by fire recently, ruining a large portion of the stock, just inventoried at $32,000.

An interesting relic of the great fire of 1871 has been unearthed at Chicago, in preparing for the foundations of the new Masonic Temple. The site of Hall & Kimball's iron warehouse was at this point at the time of the fire, and their stock of bar iron melted and imbedded itself in the earth. In excavating for new foundations, a mass of this iron, estimated to weigh 28 tons, has been uncovered.

The Babcock & Wilcox Co., of New York, manufacturers of water tube boilers, have just opened a Cleveland office, at 412 Perry-Payne Building, this being a branch of the Pittsburgh office, of which Mr. W. C. Temple is Manager. Mr. George A. Humphreys, who has for many years been connected with the boiler business, having been at one time the Pittsburgh agent for the Heine Boiler Co., of St. Louis, will have charge of the Cleveland business. The Babcock & Wilcox Co. have recently started up a plant of boilers for the Cleveland City Cable Railway Co., which is well worth inspection. They have also just finished putting up a plant of boilers for Messrs. Perkins & Co., at their Mabel furnaces, Sharpsville, Pa.

Eagles,
Rosettes,
Leaves,
Scrolls,
Center
Pieces,
Spun
Work,
Galvanized
Iron
Cornices,
Building
Fronts,
Finials,
Crestings.

Send for catalogues and prices to

W. H. Mullins

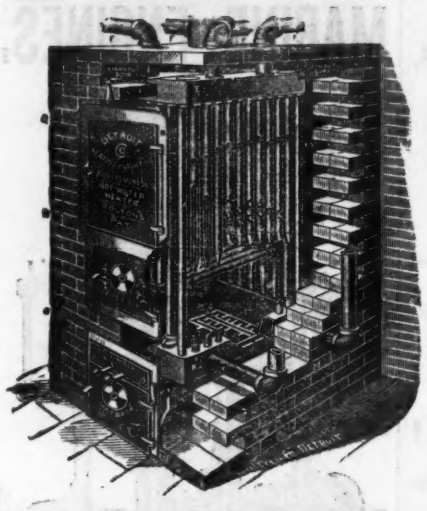
150 DEPOT ST.,

SALEM, O.

J. T. WAGNER, Sales Ag't,

108 Chambers St., N. Y.

BOLTON



Best for Warming Dwellings, Greenhouses, Schools, &c.
Most Economical, Durable and Easily Managed.

HOT-WATER HEATER

Safe. Clean.

BEST RECORD IN CANADA AND THE BLIZZARD NORTHWEST.

And Radiators.

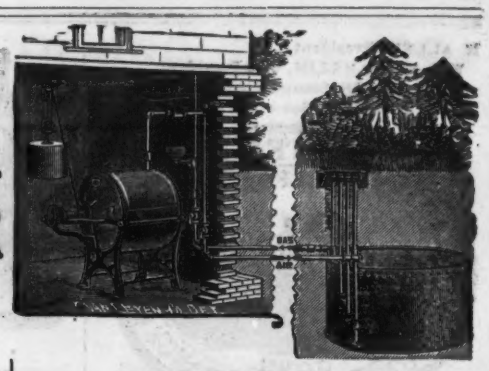
Its Vertical Circulation renders its action Prompt and Rapid.
Its Fire Surface is the largest in proportion to Grate Surface.
No Bolted, Flanged or Packed Joints; therefore cannot Leak.
Its Brick Casing entirely prevents loss of Heat in Cellar.
Wrought Iron; therefore cannot Crack.

WEBER STRAIGHTENING VALVES.

Send for Circulars.

Detroit Heating & Lighting Co.,

88 Lake St., Chicago, Ills. 396 Wight St., Detroit, Mich.



COMBINATION

Gas Machine

Best Independent Gas Apparatus

For Country and Suburban Residences, Churches, Schools, Stores, Hotels, Etc.

Over 20 Years in use, with never an Accident.

Average cost of gas, ½ cent per hour per burner.

HERE IS YOUR CHANCE.

Can Any One Make Better Club Rates than the Following?

SCRIBNER'S	Monthly, with Iron Trade Review,	$4.50
CENTURY,	" " " " "	5.50
ST. NICHOLAS,	" " " " "	4.50
COSMOPOLITAN,	" " " " "	3.50
FRANK LESLIE'S POPULAR,	" " " " "	4.50
" " BUDGET OF WIT,	" " " " "	4.00
" " PLEASANT HOURS,	" " " " "	3.50
OUTING,	" " " " "	4.25
NORTH AMERICAN REVIEW,	" " " " "	6.00
LIFE,	Weekly " " " "	5.75
TEXAS SIFTINGS,	" " " " "	3.00
JUDGE,	" " " " "	5.75
JUDGE'S LIBRARY,	" " " " "	3.00
FRANK LESLIE'S ILLUSTRATED NEWSPAPER,	" " " " "	5.25

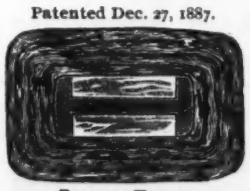
The above for new subscriptions only. Send in your subscriptions to

THE IRON TRADE REVIEW

Cleveland, Ohio.

It is not a Dead, but a Live Elastic Packing.

Patented Dec. 27, 1887.

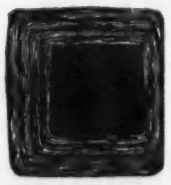


BEFORE USING.

That will pack a Steam, Water, Oil, Air or Ammonia Rod, also a Smooth, Fluted, Out-of-Round or Vibrating Rod, an Engine, Pump, Ice Machine, Air Compressor, Steam Hammer, Rotary Rod, or any rod that has to be packed, and keep it tight without pressure or friction, as it works automatically.

We will prove this by yourself. If you will send for enough to pack a rod, we will send it on 30 days' trial, and prove to you that the "Sensible" Automatic Packing is the "Best" made, therefore is "Cheapest."

SOLE MAKERS:



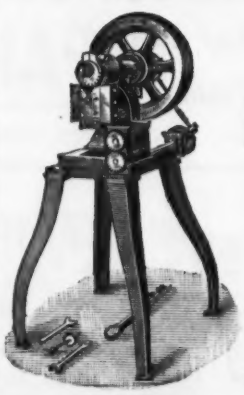
AFTER USING.

Sensible Automatic Packing Co., 63 So. Canal St., Chicago, Ill.

Strong, Well Built, Serviceable
12 TO 80 HORSE POWER.

STEAM ENGINES

ADAPTED TO HEAVY, CONTINUOUS WORK.
EVERY ENGINE TESTED UNDER FULL LOAD.
FOR DESCRIPTIVE CIRCULARS ADDRESS
CHANDLER & TAYLOR CO., INDIANAPOLIS, IND.



THE TOLEDO MACHINE TOOL CO.,

MANUFACTURERS OF

PRESSES, DROP PRESSES, DIES,

AND

Special Machinery

DESIGNED AND BUILT TO ORDER.

Dies for all kinds of sheet metal goods, leather, paper, etc. Inventors' models and specialties. Send for circulars and prices.

St. Clair and Washington Streets.

Mention this paper. TOLEDO, O

IRON FOUNDRY

CANTON IRON FOUNDRY CO.,
Canton, Ohio.
HEAVY AND LIGHT CASTINGS.
Privilege to make estimates solicited.

M. ALLEN, President.
WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

GEO. P BURWELL, Gen'l Agt., 208 Superior St., Cleveland, O.
C. A. BURWELL, Chief Inspector, 208 Superior St., Cleveland, O.
A. D. BAITH, Special Agt., 208 Superior St., Cleveland, O.
R. D. BRIGGS, Special Agt., 208 Superior St., Cleveland, O.
J. E. WOLCOTT, Special Agt., Akron, O.

VICTOR COLLIAU,

Sole Manufacturer OF THE

Improved Patent HOT BLAST Colliau Cupola

ADDRESS:

287 Jefferson Ave. DETROIT, MICH.

JOHN ADT & SON,

New Haven, Conn.,

Builders of Machinery for Hardware Manufacture,

AUTOMATIC

Wire Straightening and Cutting Machines,

Butt Milling Machinery, Butt Drilling Machinery Riveting Machines, Drilling and Countersinking Machines, Foot Presses, Sprue Cutters, Etc.

INDUSTRY FILE WORKS,

A. & H. Gough, Props.,

Manufacturers of

Files and Rasps,

Equal to the Best English File.

OLD FILES RE-CUT.

All Kinds of Job Grinding.

OFFICE & WORKS,

48 COLUMBUS ST.,

CLEVELAND, O.

C. GOUGH Manager.

Mention this paper.

SHEPARD'S NEW $60

SCREW CUTTING

Foot Lathe

Foot & Power Lathes, Drill Presses, Scroll-Saw Attachm'ts, Mandrels, Chucks, Twist Drills, Dogs, Calipers etc. Lathes on trial Lathes on payment. Send for catalogue of Outfits for Amateurs or Artisans. Address H. L. SHEPARD, Agt., 124 East Second St., Cincinnati, O.

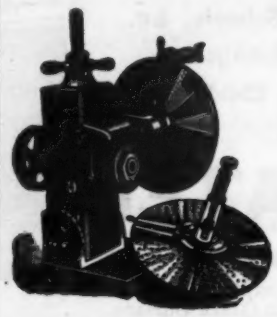
S. T. W. Ejector.

For Raising Water from Deep Wells, Streams, Excavations, &c.

The cheapest made. Send for prices.

JAMES JENKS,

Detroit, Mich.



Palmer's Gear Cutting Attachment

CAN BE USED ON ANY SCREW-CUTTING LATHE FOR

Amateurs, Clock Makers, Model Makers, Knitting Machine Makers, Tool Makers,

Or any one having use for SMALL GEARING.

For particulars, address

PALMER, CUNNINGHAM & CO., L't'd,

607 Market St., PHILADELPHIA, PA.

G. W. STOCKLY, President. J. J. TRACY, Vice-President. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. J. POSSONS, Asst. Supt.
S. M. HAMILL, Jr., Assistant Secretary.

THE BRUSH ELECTRIC CO.,

Sole Manufacturers under all the PATENTS OF CHARLES F. BRUSH, FOR ELECTRIC LIGHTING, STORAGE BATTERIES, CARBONS, ELECTRO-PLATING MACHINES, ELECTRO MOTORS, ETC.

The Brush Light Still Leads the Field.

No other System in the World equals ours in Simplicity, Durability, Earning Capacity, Reliability. The Best is always the Cheapest. 45,000 Brush Arc Lamps now in use. Self-Regulating Incandescent Apparatus.

GET OUR AGENT TO MAKE PLANS FOR YOU BEFORE BUYING ELSEWHERE.

THE BRUSH ELECTRIC CO.,

CLEVELAND, OHIO, U. S. A.

Agencies Everywhere.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g,

CLEVELAND, OHIO.

Trade Mark Patented.

ORDER DIRECT FROM THE

Iron Clad Paint Co.

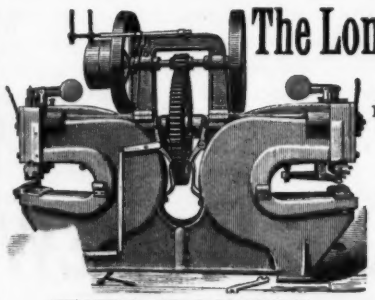
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and cheapest Paint made.

FURNISHED both Dry and Ground in Oil.

USED BY NEARLY ALL THE RAILROADS

The Long & Allstatter Co., HAMILTON OHIO.



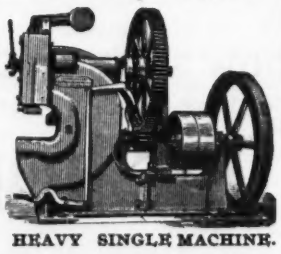
HEAVY DOUBLE MACHINE.

Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam Driven

PUNCHES AND SHEARS.

—Over 300 Sizes—

SEND FOR NEW CATALOGUE.



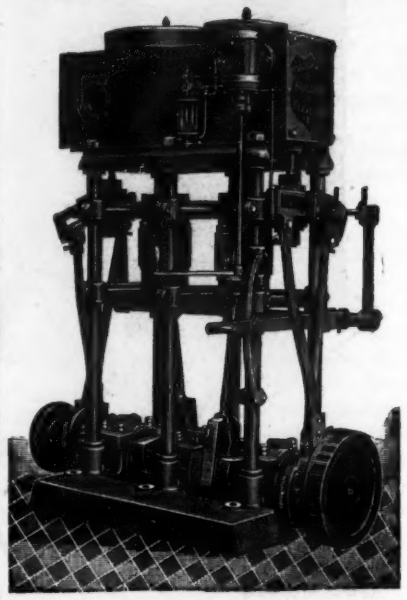
HEAVY SINGLE MACHINE.

AKRON CHEMICAL CO.,

Imperial Car and Bridge Paints. **PAINTS.** Black Asphaltum Paints. All grades.

150 State Street, AKRON, O.

COMPOUND AND MARINE ENGINES.



HIGH PRESSURE, STEEPLE AND FORE AND AFT

COMPOUNDS.

—Send for Photo and Prices.—

CLOUGH, WITT & CO.,

CLEVELAND, OHIO.

Shipman Automatic Steam Engine; petroleum, kerosene or natural gas fuel. Automatic in fuel and water supply. Stationary and marine. 1, 2, 4, 6 and 8 horse-power single; 8, 12, 16 and 22 horse-power compound. No engineer. Send for catalogue. Mention *Iron Trade Review*. C. H. PRESLEY, manufacturers' supplies, tools and machinery, 24 80. Water St., Cleveland, O.

JAS. MURDOCK, JR.,
Manufacturer of
STEEL STAMPS,
NAME PLATES,
TIMES & TOOL ROOM CHECKS.

NILES TOOL WORKS 25

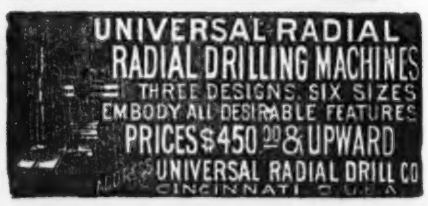
52 Longworth St. Cincinnati, O.

FOR
ARTISTIC
PRINTING
WRITE
CLEVELAND
PRINTING &
PUBLISHING CO.,
CLEVELAND, O.

Steam Jet Pumps,	From	$4.00 up.
Automatic Injectors,	"	$5.00 up.
High Lifting Injectors,	"	$6.00 up.
Shafting, Hangers,	"	$1.00 up.

COUPLINGS, BOXES, COLLARS, ETC.
Write for Circulars, Etc.

COLUMBIA INJECTOR CO., CLEVELAND, O.



IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, net cash): Bessemer, $17 30; No. 1 Foundry, $16 80; No. 2 Foundry, $15 80; No. 1 Gray Forge, red short, $14 80; No. 2 Gray Forge, neutral, $14 30; No. 1 American Scotch, $16 80; No. 2 American Scotch, $15 80.

CHICAGO (reported by Messrs. Rogers, Brown & Merwin): Southern Coke No. 1 foundry, $16 25@17 00; Southern Coke No. 2 Foundry, $15 50@16 50; Southern Coke No. 3 Foundry, $15 00@16 00; Southern Coke No 1, Softeners, $15 50@16 50; Southern Coke No. 2, Softeners, $14 75@15 50; Ohio Silveries No. 1, $18 00@18 75; Ohio Silveries No. 2, $17 00@ 17 75; Ohio Strong Softeners No. 1, $18 25@19 50; Ohio Strong Softeners No. 2, $17 50@18 75; Lake Superior Charcoal Nos. 1 to 6, $18 50@19 50; Tennessee Charcoal No. 1, $19 00@20 00; Tennessee Charcoal No. 2, $18 00@19 00; Southern Standard Car Wheel, $22 00@24 50; Tennessee Standard Car Wheel, $19 50@20 50.

CINCINNATI (reported by Rogers, Brown & Co.): FOUNDRY IRONS—Southern Coke, No. 1 foundry, $14 50@15 00; Hanging Rock Coke, No. 1 foundry, $16 50@17 50; Jackson Co. Stone Coal, No. 1 foundry, $17 00@17 50; Tennessee Charcoal, No. 1 foundry, $16 50@17 50; Hanging Rock Charcoal, No. 1 foundry, $20 00@22 00. MILL IRONS—Standard Southern Coke, grey forge, $12 50@12 75; Standard Southern Coke, mottled, $12 25@12 50; Cold Short Southern Coke, grey forge, $12 25@12 50; Strong Ohio Neutral Coke, grey forge, $14 50@15 00. CAR WHEEL AND MALLEABLE—Standard Alabama Car Wheel, $20 00@20 50; Tennessee Car Wheel, $18 50@19 50; Lake Superior Car Wheel, $19 50@20 50.

BUFFALO (reported by Rogers, Brown & Co.): Mahoning and Shenango Valley strong, No. 1 Foundry, $17 25@00 00; Mahoning and Shenango Valley strong, No. 2 Foundry, $16 25@00 00; Ohio Softener No. 1, $17 25@00 00; Ohio Softener No. 2, $16 25@ 00 00; Jackson Co. Silveries, $18 00@19 00; Lake Superior Charcoal, $20 00@00 00; Tennessee Charcoal, $19 00@00 00; Southern Softener No. 1, $16 25@00 00; Southern Softener No. 2, $15 50@00 00; Southern Strong No. 1 Foundry, $17 00@00 00; Southern Strong No. 2 Foundry, $16 25@00 00; Alabama Car Wheel, $23 00@24 00; Hanging Rock Charcoal, $23 00@24 00.

LOUISVILLE (reported by Hall Bros. & Co.) HOT BLAST FOUNDRY—Southern coke No. 1, $14 25@14 50; Southern coke No. 2, $13 75@14 00; Southern coke No. 3, $13 25@13 50; Mahoning Valley (Lake ore mixtures), $00 00@00 00; Southern charcoal, No. 1, $16 50@17 00; Southern charcoal, No. 2, $16 00@16 50; Missouri charcoal, No. 1, $17 50@18 00; Missouri charcoal No. 2, $17 00@17 50. FORGE—Neutral coke, $12 50@13 00; Cold short, $12 50@13 00; Mottled, $12 00@12 25. CAR WHEEL AND MALLEABLE—Southern (standard brands), $21 00@22 00; Southern (other brands), $17 50@18 00; Lake Superior, $21 50@22 50.

ST. LOUIS (reported by Rogers, Meacham & Shields): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 50@16 00; Southern Coke No. 2, $14 50@15 00; Southern Coke No. 3, $14 00@14 50; Southern Grey Forge, $13 50@14 00; Southern Charcoal No. 1, $17 50@18 00; Southern Charcoal No. 2, $17 00@17 50; Missouri Charcoal No. 1, $15 50@16 00; Missouri Charcoal No. 2, $15 00@15 50; Ohio Softeners, $18 00@19 50. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $20 50@21 00; Southern, $19 00@21 00. CONNELLSVILLE COKE—East St. Louis, $5 50; St. Louis, $5 65.

DETROIT (reported by William P. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $19 00@19 50; Lake Superior (coke) Bessemer, $18 00@18 50; Katahdin (Maine Bessemer), $23 00@24 00; Lake Superior Coke, Foundry, all ore, $18 00@18 50; Lake Superior Coke, Foundry, all ore, $00 00@00 00; Standard Ohio Black Band, $18 00@18 50; Southern No. 1, $15 75@16 25; Southern Gray Forge, $14 00@14 00, Jackson County (Ohio) Silvery, $18 25@18 75 Old Car Wheel, $00 00@00 00. Connellsville Coke, $4.65.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry $14 00@14 50; Southern Coke No. 2 Foundry $13 50@14 00; Southern Coke No. 3 Foundry $13 00@13 50 Grey Forge. $12 50@13 00; Southern Coke Silver Grey, $00 00@00 00; Southern Charcoal No. 1 Foundry, $16 00@17 00; Car Wheel, $17 00@20 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $17 00@17 25; No. 2 Foundry, $16 00@16 25; Grey Forge, $15 00@15 25; White and Mottled, $14 00@14 25; Warm Blast Charcoal, $18 00@21 00; Cold Blast Charcoal $23 00@27 00; Bessemer, $17 00@17 50.

MERCHANT IRON AND STEEL.

Flat Bar.

1½ to 4 by ⅜ to 1 inch	1 80
4½ to 6 by ⅜ to 1 inch	1 90
1½ to 6 by 1¼ to 2 inch	2 20
1¼ & 1¾ by ⅜ to ½ inch	1 90
1 & 1¼ by ⅜ to ½ inch	2 00
⅝, ¾ and ⅞ by ⅜ to ½ inch	2 20

Round and Square.

1 to 1⅜ inch	1 80
2 to 2¾ inch	2 00
2¾ to 3¼ inch	2 0
3¾ to 4 inch	2 80
4¼ to 4½ inch	3 20
4¾ to 5 inch	3 50

Oval.

½ to 1¼ inch	2 20
⅝ to ¾ inch	2 0
⅞	2 60
1	3 00

Half Oval and Half Round.

1¼ to 3 inch	2 90
⅝ to 1¼ inch	2 50
⅝ to ¾ inch	3 10
⅞	3 0
1	4 80

Heavy Band.

¼ to 6 by ¼ and 5-16 inch	2 00
to 1½ by ¼ and 5-16 inch	2 0
1¼ to ¾ by ⅜ and 5-16 inch	2 30
1¼ to ¾ by ⅜ and 5-16 inch	3 80

Hoops.

1¼ to 4, Nos. 13 to 15	2 60
1¼ to 2, Nos. 16 to 18	2 70
1¼ to 2, No. 19	2 80
1¼ to 2, No. 20	2 90
1¼ to 2, No. 21	3 00
1¼ to 2, No. 22	3 10
15-16, 1 and 1⅛, Nos. 13 to 15	2 80
15-16, 1 and 1⅛, Nos. 16 to 18	2 90
15-16, 1 and 1⅛, Nos. 19 and 20	3 00
15-16, 1 and 1⅛, No. 21	3 10
15-16, 1 and 1⅛, No. 22	3 20
⅞, Nos. 13 to 15	3 00
⅞, Nos. 16 to 18	3 10
⅞, Nos. 19 and 20	3 20
⅞, No. 21	3 30
⅞, No. 22	3 40
13-16, Nos. 13 to 15	3 20
13-16, Nos. 16 to 18	3 30
13-16, Nos. 19 and 20	3 40
13-16, No. 21	3 50
13-16, No. 22	3 60
¾, Nos. 13 to 15	3 30
¾, Nos. 16 to 18	3 50
¾, Nos. 19 and 20	3 60
¾, No. 21	3 70
¾, No. 22	3 80
11-16, Nos. 13 to 15	3 50
11-16, Nos. 16 to 18	3 70
11-16, Nos. 19 and 20	3 80
11-16, No. 21	3 90
11-16, No. 22	4 00
⅝, Nos. 13 to 15	3 80
⅝, Nos. 16 to 18	4 00
⅝, Nos. 19 and 20	4 10
⅝, No. 21	4 20
⅝, No. 22	4 30
⅝, No. 23	4 50

Light Band.

1¼ to 6 by ¼ to 3-16 in	2 20
1¼ to 6 by Nos. 11 and 12	2 30
1 to 1¾ by ¼ to 3-16 in	2 40
1 to 1¾ by Nos. 11 and 12	2 50
⅞ and 13-16 by ¼ to 3-16 in	2 70
⅞ and 13-16 by Nos. 11 and 12	2 80
¾ and 11-16 by ¼ to 3-16 in	3 00
¾ and 11-16 by Nos. 11 and 12	3 10
⅝ and 9-16 by ¼ to 3-16 in.	3 20
⅝ and 9-16 by Nos. 11 and 12	3 40
½ by ¼ to 3-16 in	3 60
½ by Nos. 11 and 12	3 70

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	2 80
⅜ inch, " " " 13 and 14	3 00
¼ inch, " " " 11 and 12	3 10
¼ inch, " " " 13 and 14	3 30

Sheet Iron:

No. 10 to 14	2 65
No. 15 to 17	2 75
No. 18 to 21	2 90
No. 22 to 24	3 15
No. 25 to 26	3 30
No. 27	3 40
No. 28	3 50

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 60
C No. 1, " "	2 85
C H No. 1 " "	3 10
C H Flange, " "	3 85
Extra Flange, "	4 35
Solid Fire Box "	5 10

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 75
Shell	3 15
Flange	3 45
Marine Flange	3 85
Fire Box	4 55

Above includes plates 90 inches wide.

90 to 96 in. wide	¼c lb extra
96 to 100 in. wide	1 c "
100 to 104 in. wide	1¼c "
104 to 116 in. wide	special

American Cast Tool Steel.

ROUND, SQUARE AND OCTAGON.	cts. lbs
1 to 2 in. inclusive	09
9-16 to ⅞ in "	09
7-16 to ⅝ and 2¾ to 3 in	10½
3⅛ to 4 in	11
⅝ to 11-16 and 4¼	10½
⅝ to 6 in	11½
¼ to 9-32 and 6¼ to 7 in	12
3-6 in	14

Flats.

	cts. lbs
2 to 9-16 wide by 2 to ⅝ thick	9

Bessemer and O. H. Steel.

Machinery	base price,	2 75
Tire	"	2 75
Spring	"	3 25
Sleigh Shoe	"	2 75
Toe Calk	"	3 00
Cutter Shoes, tapered and burr.	"	3 00

English Tool Steel.

Jessop's	16c
Hobson's "Best"	16c
" "Choice"	36c

Burden Boiler Rivets.

⅛, ¾, 11-16 and ¼ inches diameter	4 00
Bridge ⅛, ¾, 11-16 and ¼ inch diam	4 00

SCRAP IRON AND OLD METAL.

	NET TONS
No. 1 R. R. wrought scrap	$19 00
No. 1 wrought scrap	17 00
No. 1 Machine cast scrap	13 00
Iron axles	24 00
Axle turnings	13 50
Wrought turning (free from cast)	12 00
Cast borings	8 00
Uncut wrought iron boilers	11 00
Steel boiler plates	17 00
Grate Bars	8 00
Pipes and flues (Clean)	13 50
Tank iron	13 50
Hoop and band iron	10 00
Sheet iron	9 50
Wrought drillings	11 00
Malleable iron	10 00

Reported by Messrs. BLACK & POLLOCK, Cincinnati, O.:

Railroad Wrought	$20 00
No. 1 Country Wrought	17 00
Stove Plate	8 75
Machine Castings	11 00
Hoop and Sheet	8 00
Casting Borings	9 00
Wrought Turnings	12 00

CLEVELAND ROLLING MILL CO.,

MANUFACTURERS OF

BESSEMER STEEL RAILS,

Blooms and Billets, Steel Angles, Forgings, Bar and Spring Steel, Steel Street Rails, Steel Oil Barrel Hoops, Wire of all Kinds, Iron and Steel Boiler Plates, Galvanized and Black Sheet Iron, Corrugated Iron Roofing, Sheet Steel.

THE CAMBRIDGE IRON & STEEL CO.

MANUFACTURERS OF

SHEET IRON AND SHEET STEEL

CAMBRIDGE REFINED IRON. TRADE MARK

Squared Roofing Sheets a Specialty.

CAPACITY RANGES FROM No 30 26 INCHES WIDE TO 1-4×40×120

CAMBRIDGE SOFT STEEL. TRADE MARK

CORRESPONDENCE SOLICITED

OFFICE AND WORKS CAMBRIDGE, OHIO.

Magnetic Concentration of Iron Ore.

Ball-Norton (Monarch) Electro Magnetic Separator.

Phosphorus, sulphur, silica, hornblende and other impurities eliminated from Iron Ore, and non-Bessemer ore converted into Bessemer Ore. Samples treated without charge. Correspondence solicited.

H. E. COLLINS & CO., Agents Magnetic Separator Co.,

BANK OF COMMERCE BUILDING, PITTSBURGH, PA. ALDRICH COURT, 45 BROADWAY, NEW YORK

Cleveland Iron Mining Co.,

Mercantile Bank Building,

CLEVELAND, O.

Organized 1850.

Total Production to Date, 4,200,000 Gross Tons.

Dealers in Lake Superior iron ore from their own mines at Ishpeming, Mich.

Specially adapted for making strong, tough iron, and for carrying large proportions of mill cinder and cold short ores.

DALLIBA, CORRIGAN & CO.,

DEALERS IN

Iron Ore & Pig Iron,

Rooms 716, 717, 718, 719 Perry-Payne Bld'g,

CLEVELAND, O.

OGLEBAY, NORTON & CO.,

Successors to Tuttle, Oglebay & Co.,

Commission Dealers in

Iron - Ores,

FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,

CLEVELAND, OHIO.

J. H. OUTHWAITE. W. G. POLLOCK.

J. H. OUTHWAITE & CO.,

Exclusive attention given to

LAKE SUPERIOR AND MENOMINEE RANGE

Iron Ore,

Perry-Payne B'ld'g. Cleveland, O.

THE CONDIT-FULLER CO.,

Pig and Bar Iron,

CLEVELAND, OHIO.

E. C. POPE,

COMMISSION DEALER IN

Iron Ore, Pig Iron

AND METALS.

Cleveland, - Ohio.

PITTSBURGH & WHEELING COAL CO.,

MINERS AND SHIPPERS OF

Ohio Steam Coal and Coke.

Mines on the Cleveland, Lorain & Wheeling R. R. Capacity, 3,000 tons daily.

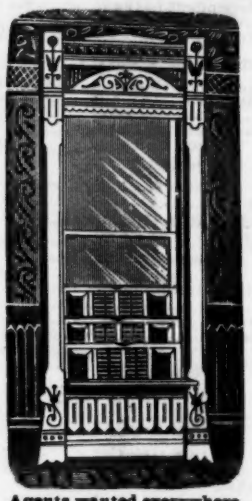
Office, 6 Mercantile Bank Building,

CLEVELAND, OHIO.

Lake Shipping Point, Lorain, O.

JAS. PATTERSON, Sales Agent.

Hartman's Patent Inside Sliding Window Blind



is the most popular Blind in America. Architects & builders prefer it to any other, for merit, style, convenience and economy.

Not Complicated.

The Only Blind that is furnis'd with an automatic Burglar-Proof Lock, free of charge. This is an item of immense magnitude, and may save you many times the cost of blinds & perhaps life also, and the only blind that gives entire satisfaction. Thousands are in use.

Agents wanted everywhere. Send for illustrated catalogue and prices. Manufactured by

HARTMAN & DURSTINE, No. 59 Beaver St. Wooster, O.

For Sale.

—ONE—

Harlow Lubricator.

Brand new. Cheap. Address,

LUBRICATOR,

Care Iron Trade Review.

ESTABLISHED 1854.

PETER GERLACH & CO.,

MAKERS OF

Saws, Tools and Machinery.

Office and Warerooms, 28 Columbus st. Factories on Columbus, Winter and Leonard streets.

Cleveland, O., U. S. A.

COWLES

Pure Aluminum

$1.25 PER POUND.

Quality guaranteed equal to any on the market. Manufactured by

The Cowles Electric Smelting & Aluminum Co.,

LOCKPORT, N. Y.

Also manufacturers of

Cowles Aluminum Bronze,
Cowles Aluminum Brass,
Cowles Silver Bronze,
Cowles Silicon Bronze,
Cowles Aluminum Iron

INGOTS AND CASTINGS.

Correspondence solicited.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 12

Bellows.

Blacksmiths' { Hill's.....dis 40
Bullock's.....dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard..dis 60&10
Shults Raw Hide Leather Belting, single.....dis 40
Shults Raw Hide Leather Belting, double and Light Double.....dis 40
Standard, oak tanned.....dis 50@60
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 9¾@10¾

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 65

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3½

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1⅜".....dis 50&10
Morse Taper and Straight shank Larger than 1⅜".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2½c
¼ kegs ₩ lb	4¼c	5¾c		2¾c
½ kegs ₩ lb	4½c	5½c		3 c
10 lb cans, 10 in case	6 c	6½c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@50&5

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 50
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	15¾	11¾	8¾	6	5⅜	5⅛	5
Washers	9	8	7	5	4½	4⅛	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate { Car lots.....$2.30 { Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¼ inch and over.....₩ lb 13¾
Sisal, ¼ inch and over .....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis 45@50
H. H. Barton's.....dis 40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 40@45
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 20
Atkins' Circular Saws.....dis 40&45
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 52c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay .....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ⅛ lb Balls		21c@29c
No. 18 " " ¼ and ⅛ "		18c@28c
No. 36 " " ¼ and ⅛ "		16c@27c
2-Ply Hemp, ¼ & ⅛ lb Balls (Spring Twine)		11¼c
3-Ply " 1 lb Balls		12@12¾c
3-Ply " 1¼ lb Balls		11@11¼c
Cotton Wrapping, 5 Balls to lb		15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30

Wire.

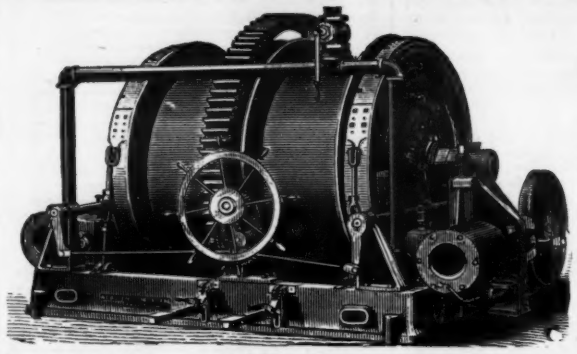
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 3

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40

Webster, Camp & Lane Machine Co.



MANUFACTURERS OF

Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.

Send for Catalogue D. 134 N. Main St., AKRON, OHIO.

THE GUM ELASTIC ROOFING

IS ABSOLUTELY NON-COMBUSTIBLE. If painted it is Guaranteed to last 10 years. Costs only $2.00 per 100 square feet. Strongly endorsed by New York Board of Underwriters. Just the article for the South. Send stamp for circulars, samples and particulars.

GUM ELASTIC ROOFING CO., 41 West Broadway, New York City.

THE THOS. D. WEST FOUNDRY. CO.

CLEVELAND. O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS—SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY

Detachable and Roller

CHAIN BELTING,

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

Send for 1890 Illustrated Catalogue. Address

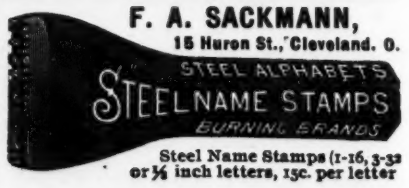
The Jeffrey M'f'g Co.,

183 East 1st Ave.,

COLUMBUS, O.

F. A. SACKMANN,

15 Huron St., Cleveland. O.



Steel Name Stamps (1-16, 3-32 or ⅛ inch letters, 15c. per letter

PATENTS

WM. M. MONROE,

SOLICITOR & COUNSELLOR, City Hall Room 48.

PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.

UNION ELECTROTYPE FOUNDRY

TELEPHONE 2179

829 SHERIFF ST. CLEVELAND O.

STEEL CASTINGS

FROM 1-4 TO 15,000 LBS. WEIGHT.

True to pattern, sound, solid, free from blow-holes and of unequaled strength.

Stronger and more durable than iron forgings in any position, or for any service whatever.

60,000 CRANK SHAFTS and 50,000 GEAR WHEELS of this steel now running prove this.

Crossheads, Rockers, Piston-Heads, etc., for Locomotives. STEEL CASTINGS of every description.

Send for circulars and prices to

Chester Steel Castings Co.,

WORKS: CHESTER, PA. OFFICE 407 LIBRARY ST., PHIADELPHIA, PA.

"Treated" COTTON, Rubber Lined

Fire and Mill Hose.

Fabric Fire Hose Co.,

13 and 15 Park Row, NEW YORK, N. Y.

OIL ALWAYS BELOW BURNERS---BY USING OUR SYSTEM.
OUR SYSTEM IS INSURABLE IN ALL INSURANCE COMPANIES.
WE GUARANTEE INSURANCE WHEN PLANT IS INSTALLED ACCORDING TO OUR SPECIFICATIONS.

THE AERATED FUEL CO.,

425 MAIN STREET, SPRINGFIELD, MASS.

FORGING, WELDING, BRAZING, MELTING, ANNEALING, HARDENING, TEMPERING.

THE GILBERT & BARKER MFG. CO., Springfield, New York and Boston, General Agents for U. S.

Represented by { W. S. COLLINS, Temple Court, 7 Beekman St., Rooms 814-816, New York. / WM. PICKETT, SON & CO., 170 Lake St. Chicago, Ill. / HALL STEAM PUMP CO., Pittsburgh, Pa. Also for Michigan and Indiana. IB. } CHILION JONES, Gananoque, Ontario. G. M. SMITH, Los Angeles, Cal.

SEND FOR CATALOGUES.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $8 00
Others.....℔ doz $7 00
Full polished.....℔ doz $9 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 70&10&5
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&10
Loose joint, jap.....dis 70&10
Loose joint, jap. with acorns.....dis 70&10
Loose pin, acorns.....dis 70&10
Loose pin, japanned acorns.....dis 70&10
Loose pin, acorns, jap. plated tips.....dis 70&10
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10
Wrought, fast joint, broad.....dis 70&10
Wrought, loose joint, broad.....dis 70&10
Table Butts, back flaps, etc.....dis 70&10
Regular inside blind.....dis 70&10
Light inside blind.....dis 70&10
Loose pin.....dis 70&10
Light loose pin.....dis 70&10

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

	Per roll of 500 sq. feet.
Eberts Bros., Detroit.	
No. 1—Slaters'.....	$1.25
"A," Stringed Roofing, Light.....	1.50
"B," Stringed Roofing, Medium.....	1.75
"C," Stringed Roofing, Heavy.....	2.00
Stringed, Rosin-Sized.....	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton.....$30.00
Asphaltum, Fine Grade, ℔ lb.....08
Coal Tar Felt, 1 Ply, ℔ lb.....02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft.....1.42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft.....1.85
Roofing Pitch, ℔ gal.....09

Chains.

Revised List.

Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ 5½@6
Jack Chain, Iron.....dis 75&10
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber, Slop, Commode 5 and 5X 14 qt.	6 50	7 50	8 50
Tubs, slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10¼ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13¾ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed			
8 inch	4 00	4 50	5 00
10 and 11¾ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 60&10&10@70
Climax, (Anti-Friction).....dis 60
Scranton.....dis 33—
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ D.	23	24	25	26	28	dis 40
Putnam, ℔ D.	18	19	20	21	23	dis 15
Essex						dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hematite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronse Goods.
Door locks, knobs and latches.....dis 60&10
Escutcheons and keys.....dis 60&10
Padlocks and padlock keys.....dis 75
Bell pulls, mineral, porcelain and jet dis 60&10
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronse.....dis 60&10
Butts', genuine bronse.....dis 60&10
Butts' bronse plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronse.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronse.....dis 70
Shutter knobs, genuine bronse.....dis 50
Shutter bars, genuine bronse.....dis 60
Sash lifts, genuine bronse.....dis 60
Sash pulls and plates, genuine bronse.....dis 60
Push plates, genuine bronse.....dis 60
Drawer pull, genuine bronse.....dis 70
Letter box plates, genuine bronse....dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leve s.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@$[illegible]...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron, Nickel plated.....dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 50&10

Tacks, Brads, Etc.

New List, Oct. 19, 1890.

American iron carpet tacks all kinds dis 77½&10
Steel carpet tacks all kinds.....dis 75&10
Swedes iron carpet tacks, all kinds dis 75&10
Swedes iron tacks.....dis 75&10
Swedes iron Upholsterers' tacks.....dis 75&10
Tinned Swedes iron tacks.....dis 77½&10
Tinned Swedes iron Upholsterers' tacks.....dis 77½&10
American iron cut tacks.....dis 77½&10
Copper tacks.....dis 4 &10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10
Finishing nails.....dis 62&10
Hungarian nails and miners' tacks...dis 60&10
Gimp and lace tacks.....dis 77½&10
" " " tinned.....dis 60&10
Trunk and clout nails.....dis 72½&10
Tinned trunk&clout nails.....dis 66&10
Basket nails.....dis 66&10
Chair nails.....dis 66&10
Common and patent brads.....dis 66&10

FREIGHT AND PASSENGER

ELEVATORS.

L. S. GRAVES & SON,

Main Office and Works, ROCHESTER, N. Y.

BRANCH OFFICES:

NEW YORK, 92 and 94 Liberty St.; BOSTON, 113 Devonshire St.; St. LOUIS, 301 Roe Building DETROIT, Hodges Building.

SEND FOR CATALOGUE.

MECHANICAL RUBBER GOODS

—OF—

Superior Quality.

PACKING, BELTING, HOSE, GASKETS, TUBING, Etc.

Fuller Brothers,

42 Public Sq., CLEVELAND, O.

AGENTS—JEWELL LEATHER BELT.

ESTABLISHED 1849. INCORPORATED 188.

The Detroit Saw Works,

MANUFACTURERS OF

CIRCULAR, GANG, DRAG, MULAY & BAND

SAWS.

Moulding and Planer Knives, Emery Wheels and General Mill Supplies.

It will pay you to get our prices and guarantee.

66, 68, 70 and 72 Fort St., East,

Mention this paper. DETROIT, MICH.

The Ullmann & Philpott M'f'g Co.,

MANUFACTURERS OF

PURE READY-MIXED PAINT, COLORS IN JAPAN AND OIL, U. & P. M'F'G CO.'S PURE WHITE AND COLORED LEADS, Etc.

80-91-93 Merwin St., CLEVELAND, O.

SAVE YOUR MONEY BY USING

(HERCULES.) —THE— (PEERLESS.)

Isaac B. Potts Pipe Fittings.

Consisting of Ells, Tees and Crosses, and the connecting of Iron Pipe without cutting threads and Lead Pipe without solder. For sale by the ISAAC B. POTTS PIPE FITTINGS CO., 306 North High Street, Columbus, O.

Classified List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks.

PAGE

Aluminum—
Cowles Electric Smelting & Aluminum Co., Cleveland ... 13

Bath Tubs—
‡Instantaneous Water Heating Co., Chicago, Ill ... —

Bolts and Bolt Machinery—
Upson Nut Co., Cleveland ... 16
†Seaton Manufacturing Co., Cleveland ... —

Belt Holders—
*W. R. Santley & Co., Wellington, O ... 20

Boilers and Boiler Attachments—
Babcock & Wilcox Co., New York ... 20
Wm. B. Pollock & Co., Youngstown, O ... 16
E. H. Jones & Co., Cleveland ... 18
Hazelton Tripod Boiler Co., Chicago ... 18

Blowers—
W. H. LaFountaine, Cleveland, O ... 18

Coal and Coke—
Pittsburgh & Wheeling Coal Co., Cleveland ... 13

Cornice Work—
W. H. Mullins, Salem, O ... 10

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O ... 18

Chain Belting—
Jeffrey Mfg. Co., Columbus O ... 14

Carpet Cleaning & Laundry Machines —
W. H. LaFountaine, Cleveland, O ... 18

Damper Regulators—
*Curtis Regulator Co., Boston, Mass ... —

Die Makers.
Avery Stamping Co., Cleveland ... 12

Drilling Machines—
Universal Radial Drill Co., Cincinnati, O ... 12

Drop Presses—
Toledo Tool & Machine Co., Toledo, O ... 11

Elevators—
L. S. Graves & Co., Rochester, N. Y ... 15

Explosives—
Hercules Powder Co., Cleveland ... 18

Electrical Manufactures—
†Cleveland Electrical Mfg. Co., Cleveland —
Brush Electric Co., Cleveland ... 12

Elevator Buckets.
Avery Stamping Co., Cleveland ... 12

Emery Wheel Flanges—
*Ware & Tapley, Chicago, Ill ... —

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill ... 20

Engravers and Electrotypers—
Eclipse Electrotype & Engraving Co., Cleveland ... 17
Union Electrotype Foundry, Cleveland ... 14

Engines (Steam)
*Chandler & Taylor Co., Indianapolis, Ind. 11
Wm Tod & Co., Youngstown, O ... 18
Skinner Engine Co., Erie, Pa ... 18
Aetna Machine Co., Warren, O ... 18
C. H. Presley, Cleveland ... 12
E. H. Jones & Co., Cleveland ... 18
Buckeye Engine Co., Salem, O ... 18
Clough, Witt & Co,, Cleveland ... 12

Engines (Gas)—
Schleicher, Schumm & Co., Philadelphia, Pa. and Chicago, Ill ... 19
Van Dusen Gas Engine Co., Cincinnati, O ... 17

Engines (Oil)
C. H. Presley, Cleveland, O ... 12

Engineers' Specialties—
*Curtis Regulator Co., Boston, Mass ... —
Sensible Packing Co., Chicago, Ill ... 11

Engineers and Contractors—
E. H. Jones & Co., Cleveland ... 18

Ejectors—
James Jenks, Detroit, Mich ... 12

Files, Makers of—
Reynolds Bros., Columbus, O ... 20
A. & H. Gough, Cleveland ... 12
Parkin & Bosworth Co., Cleveland ... 20

Forges—
Cleveland City Forge & Iron Co., Cleveland 20

Foundries—
Thos. D. West, Foundry Co., Cleveland ... 14
Canton Iron Foundry Co., Canton, O ... 20

Foundry Cupolas—
Victor Colliau, Detroit, Mich ... 12

Frost Proof Steam Traps—
*Curtis Regulator Co., Boston, Mass ... —

Furnace Feeders—
Brightman Stoker Co., Cleveland ... 19

Galvanizers.
Avery Stamping Co., Cleveland ... 12
H. H. Hodell, Cleveland ... 20

Gas Machines—
Detroit Heating & Lighting Co., Detroit, Mich ... 11

Gear Cutters—
Palmer, Cunningham & Co., Philadelphia, Pa ... 12

Gum Roofing—
Gum Elastic Roofing Co., New York N. Y. 14

Grapples, Excavators and Dredges—
Jas. H. Lancaster, New York ... 17

Heating and Ventilating Apparatus—
*Akron Heating & Ventilating Co., Akron, O ... —
W. H. LaFountaine, Cleveland, O ... 18

Hose—
Fabric Fire Hose Co., New York ... 14

Heaters and Purifiers—
Stilwell & Bierce Manufacturing Co., Dayton, O ... 20
Laidlaw & Dunn Co., Cincinnati, O ... 18
E. H. Jones & Co., Cleveland ... 18
*Warren Webster & Co., Philadelphia, Pa 20
*Exhaust Steam Purifying Co New York ... —

Hangers—
W. H. LaFountaine, Cleveland, O ... 18

Injectors—
Columbia Injector Co., Cleveland ... 12
Penberthy Injector Co., Detroit, Mich ... 20

Iron and Steel Roofing—
Sykes Iron & Steel Roofing Co., Niles, O ... 19
Cambridge Iron Roofing Co., Cambridge, Ohio ... 19
Garry Iron Roofing Co., Cleveland ... 19
Thompson Manufacturing Co., Cleveland, 19
Berger Mfg. Co., Canton, O ... 19
Eberts Bros., Detroit, Mich ... 20
Kanneberg Roofing Co., Canton, O ... 19
*W. J. Burton & Co., Detroit, Mich ... 19
*The Long Steel and Iron Roofing and Corrugating Co., Indinapolis ... —

Iron Ore, Bar and Pig Iron—
Dalliba, Corrigan & Co., Cleveland ... 13
Oglebay, Norton & Co., Cleveland ... 13
J. H. Outhwaite & Co., Cleveland ... 13
Condit-Fuller Co., Cleveland, O ... 13
E. C. Pope, Cleveland ... 13
Cleveland Iron Mining Co., Cleveland ... 13

Lathes—
H. L. Shepard, Cincinnati, O ... 12

Lathe Dogs—
Palmer, Cunningham & Co., Philadelphia 12

Mining Machinery—
Webster, Camp & Lane Machine Co., Akron, O ... 14
*Copeland & Bacon, New York ... —

Machine Shops—
Webster, Camp, & Lane Machine Co., Akron, O ... 16
Toledo Machine & Tool Co., Toledo, O ... 11

Machinists' Tools and Supplies—
Parkin & Bosworth, Co., Cleveland ... 16 &20
Garvin Machine Co., New York ... 19
C. H. Presley, Cleveland, O ... 12

Oil Fuel Process—
Aerated Fuel Co., Springfield Mass ... 15

Ore Separators—
H. E. Collins & Co., Pittsburgh, Pa ... 13

Patents—
Wm. M. Monroe, Cleveland ... 15
*Thos P. Simpson, Washington, D. C ... 14
*Munn & Co., New Kork ... —

Pumps (Steam)—
Laidlaw & Dunn Co., Cincinnati, O ... 18
E. H. Jones & Co., Cleveland ... 18
Deming Co., Salem, O ... 16

Printing Inks—
Ault & Wiborg, Cincinnati, O ... 16

Paint—
Iron Clad Paint Co., Cleveland, O ... 12
Akron Chemical Co., Akron, O ... 12
Ullman & Philpot Mfg. Co., Cleveland ... 15

Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill ... 19

Pulleys—
Ohio Pulley & Machine Co., Warren, O ... 17

Picket and Wire Fence Machines—
S. H. Garrett, Mansfield, O ... 16

Pipe Cutting & Threading Machines—
*Wells Machine Works, Fostoria, O ... 20

Packing—
Sensible Packing Co., Chicago, Ill ... 11

Pipe Fittings—
Isaac B. Potts Pipe Fitings Co. Columbus, O ... 15

Punches and Shears—
Long & Allstatter Co., Hamilton, O ... 12

Pipe and Boiler Coverings—
American Heat Insulating Co., Pittsburgh 20

Railroads—
Time Tables, Etc ... 17

Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland ... 20

Rivet Machinery—
†Seaton Manufacturing Co., Cleveland ... —

Rock Breakers and Ore Crushers—
Jas. H. Lancaster, New York ... 17

Saws—
Peter Gerlach & Co., Cleveland ... 13
Detroit Saw Works, Detroit, Mich ... 15

Shafting—
*Brightman Machine Co,, Cleveland ... —

Shapers—
*J. Steptoe & Co., Cincinnati, O ... —

Steam Heating Apparatus—
*Curtis Regulator Co., Boston, Mass ... —
Detroit Heating & Lighting Co., Detroit, Mich ... 11

Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn ... 12

Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland ... 16
F. A. Sackman, Cleveland, O ... 14
Jas. Murdock Jr., Cincinnati, O ... 12

Sheet Iron—
Cleveland Rolling Mill Co., Cleveland ... 13, 16
Cambridge Iron & Steel Co., Cambridge, O 13

Steel Castings—
Chester Steel Casting Co., Philadelphia, Pa ... 14

Steel Rails, Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland ... 13, 16

Sheet Steel—
Cambridge Iron & Steel Co., Cambridge, O 13

Stampers of Sheet Metal—
Avery Stamping Co., Cleveland ... 12

Stokers—
Brightman Stoker Co., Cleveland ... 19

Tinning Steel, Etc.
Avery Stamping Co., Cleveland ... 12

Twist Drills—
Cleveland Twist Drill Co., Cleveland ... 20
Graham Twist Drill Co., Detroit, Mich ... 20

Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland ... 20

Water Gas Furnaces—
W. S. Hutchinson, Chicago, Ill ... 20

Window Blinds—
Hartman & Durstine, Wooster, O ... 13

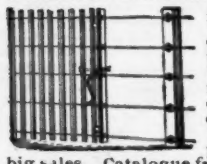
Wire Goods—
*F. Powell & Co., Toledo, O ... —

Wire Machinery—
John Adt & Son, New Haven, Conn ... 12

Wood-Working Machinery—
Indiana Machine Work, Ft. Wayne, Ind ... 16
Egan & Co., Cincinnati, O ... 19
G. H. Scanlan & Co., Portland, Me ... 16
*Battle Creek Machinery Co., Battle Creek, Mich ... —

A GREAT BARGAIN in second-hand Planing Mill Machinery, Engine, Boilers, Shafting, etc. A complete outfit at one-half its value. L. S. COLBURN, Agent, 87 Prospect St., Cleveland, O.

The Garrett Picket and Wire Fence Machine.



A universal favorite. Weaves to post in line of fence. Thousands in use throughout the United States and many of the foreign countries. Every machine guaranteed. Fence costs 30 to 50 cts. per rod. Agents report big sales. Catalogue free. Address the manufacturer, S. H. Garrett, Mansfield, O., U. S. A.

AULT & WIBORG PRINTING INKS. CINCINNATI. A&W INK USED ON THIS PUBLICATION

Keep a Record of Your Insurance

By ordering one of our Improved

Expiration Registers.

Blanks for all the essential points of each policy.

ONLY 50 CENTS (Postage paid).

Will last for years. Sample leaves sent on application. Address

The Cleveland Printing & Publishing Co.,

27, 29 and 31 Vincent Street,

CLEVELAND, O

CLEVELAND BUSINESS DIRECTORY.

Bolt and Nut Works.

THE UPSON NUT CO, Manufacturers of Nuts, Washers, Carriage, Machine, Plow and Elevator Bolts, Coach Screws, etc.

Hardware and Iron.

CLEVELAND ROLLING MILL CO., manufacturers of Steel and Iron Wire and Steel Tire.

Machinists' Supplies.

PARKIN & BOSWORTH, 9 and 11 So. Water St., dealers in Manufacturers' Supplies, Machinery and Tools.

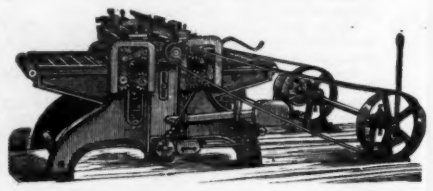
Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches and Numbering Machines. 92 Seneca St.

BUSINESS DIRECTORY.

Akron, O.

WEBSTER, CAMP & LANE MACHINE CO., Founders and Machinists, 12 Main st.

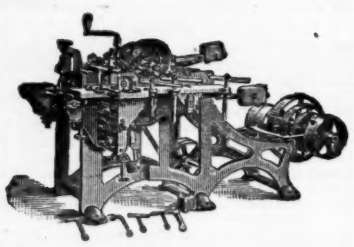


26 inch Band Saw,	$ 65 00
30 inch Band Saw,	85 00
36 inch Band Saw,	105 00
Planer Planes 24x9,	120 00
Planer Planes 18x5¼,	85 00
12 inch Buzz Planer,	85 00
Jig Saw, 6 saws,	65 00
Iron Saw Bench, 3 saws,	68 00

Other machines in proportion. All of our machines gauaranteed to give satisfaction. Send for circulars, special cash discounts, etc., before buying.

G. H SCANLAN & CO.,
96 & 98 Preble St., PORTLAND, Me.

Do Not Buy



Wood Cutting Tools

Until you have received cuts and prices from

INDIANA MACHINE WORKS,

FORT WAYNE,

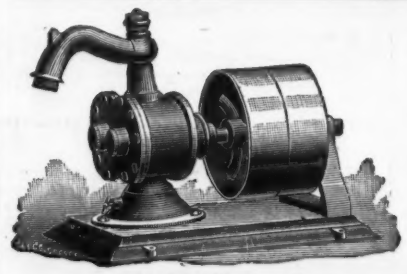
IND.

CATALOGUES

Printed in the Highest Style of Art, by

The Cleveland Printing & Publishing Co.

Cleveland, O.



THE DEMING CO.,

SALEM, OHIO.

Pumps,

For HAND AND POWER.

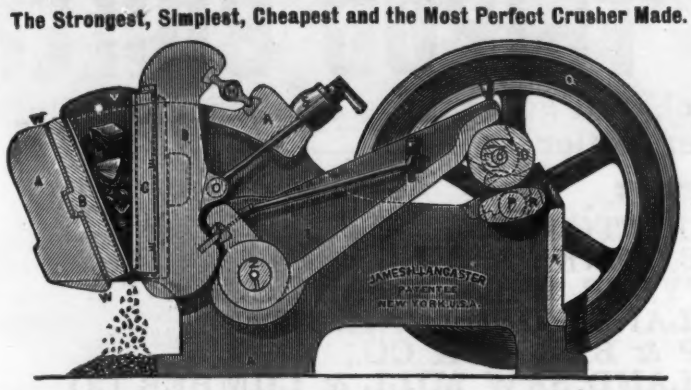
Adapted for BOILER FEEDING, FIRE PURPOSES, etc; also ARTESIAN WELL CYLINDERS and WORKING HEADS for FACTORIES, MILLS and FURNACES

Send for illustrated circular and price list. Mention this paper.

BOILERS MAHONING BOILER WORKS. PIPES, STACKS, BEAMS, ROOF TRUSSES, BLAST FURNACES ROLLING MILL WORK. WM. B. POLLOCK & CO. YOUNGSTOWN, O.

The "Lancaster" Rock Breaker and Ore Crusher

The Strongest, Simplest, Cheapest and the Most Perfect Crusher Made.



Instantly adjustable to yield any desired uniform grades of product.

Half the power only required and is less liable to breakage, and less in first cost and also in subsequent wear and tear, and less weight than any rival's breaker. For crushing rock for macadamizing and concreting purposes, and also for reducing ores, these breakers are specially efficient.

The "Lancaster" Crushers are also made in "Sections" for easy transportation in mountainous regions. May be mounted on wheels, worked by hand, horse gear and steam or other power, and also fitted with Rotary Screens, Elevators and Conveyors. Correspondence and trial tests solicited.

THE "LANCASTER"

Will automatically dig, raise and discharge mud, clay, gravel, sand, hard pan ores, rock phosphates and fire-clay from their beds and banks, and also load and unload vessels or barges with sand, coal, ores, grain and other materials. These Grapples are made of best forged steel, with four penetrating scoops, operated solely by compound leverage, thus dispensing with the inside sheaves, drums, catches, gears, chains and friction, found in all rival buckets. They may be worked by the "Lancaster" hand or horse-power, hoisters, or by any maker's double drum hoisting engines.

Send for our new illustrated price list, agency terms and testimonials, and make appointment to see our Rock Breakers, Grapples, Hand, Horse and Steam Power Hoisters at work. Comparison of our prices, capacities and merits with all rival Grapples, Rock Breakers, Hoisters, etc., earnestly solicited.

Self-Penetrating Grapple, Excavator AND Dredger.

Correspondence solicited. Manufactured and sold by the patentee.

THE 'CONLEY-LANCASTER" DIRECT STEEL PROCESS.

JAMES H. LANCASTER, (P. O. BOX 3139) 169 AND 172 BROADWAY. NEW YORK, U. S. A.

Portable GASOLINE Engines

For Threshing Machines, Hay Presses, Corn Shellers, Pile Drivers, Well Diggers, &c., our newest and latest Engine a little wonder and a *giant to work.*

Send for prices. Mention this paper.

Van Duzen Gas & Gasoline Engine Co.
CINCINNATI, OHIO.

Seeger & Guernsey's Cyclopædia of

THE MANUFACTURES AND PRODUCTS OF THE UNITED STATES;
comprises Every Article made in this Country—Indexed and Classified—and under each article the names and addresses of
THE BEST MANUFACTURERS.
Complete in One Royal Octavo Vol. of over 1000 pp.
Price in Cloth, $5. in Leather, $7.
INDISPENSABLE
to Buyers of Articles in all lines and Invaluable as a Statistical work.
· Orders received at office of this Paper ·

Wheeling & Lake Erie Railway.

THE NEW THROUGH LINE
BETWEEN
TOLEDO
—AND—
Bowerston, Pittsburgh, Marietta.
THROUGH COACHES
BETWEEN
Toledo & Marietta.
Through Sleepers Between
PITTSBURGH AND CHICAGO.
AND DAY COACHES BETWEEN
Toledo and Pittsburgh, Via Akron, Cuyahoga Falls, Kent, Ravenna, Leavittsburg, Warren, Niles, Girard, Youngstown, New Castle and Allegheny.
The Only Line running through
"BEAUTIFUL ZOAR."

A. G. BLAIR, Traffic Manager. JAS. M. HALL, Gen'l Pass. Agent.

ECLIPSE ELECTROTYPE ENGRAVING CO.

AUST & CLARK PROPRIETORS
LITHOGRAPH BUILDING CLEVELAND

TRAVELERS' REGISTER.

Standard Time.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express*	10 55 a m	*3 00 p m
Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	‡1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.
(Standard Gauge.)

Depart for—
Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.
Arrive from—
Zanesville and Coshocton—10:30 a. m., 6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	7 45 a m	d5 25 a m
	1 15 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	7 45 a m	12 50 p m
	1 15 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.....	3 25 p m	10 10 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. * Except Saturday. Other trains except Sunday.

Valley Railway.
FOR AKRON, CANTON AND MARIETTA.
Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 40 p m
Marietta Express.....	†11 15 a m	*2 55 p m
Balto. & Wash. Express....	*4 00 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 00 a m	d 7 00 am
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	1 15 p m	12 50 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	8 00 a m	5 40 p m
	3 25 p m	10 10 a m

d Daily. Other trains except Sunday.

Pullman Palace Sleeping Cars daily between Cleveland, Columbus and Cincinnati. City ticket office, Weddell House corner.

FT. WAYNE, CINCINNATI & LOUISVILLE RAILROAD.

The Popular Route Between the

NORTH and SOUTH

The Direct Route to or from
Fort Wayne, Indianapolis, Terre Haute, Evansville and St. Louis.

13 MILES SHORTER BETWEEN 13
Fort Wayne and Indianapolis,
Than any other Route.

22 MILES SHORTER AND QUICKER 22
BY THREE HOURS, BETWEEN
Louisville and Fort Wayne.

ASK FOR TICKETS VIA
Ft. Wayne, Cincinnati & Louisville R. R.

For sale by all Agents of connecting lines, East, West, North and South.

GEO. W. SAUL, Gen'l Supt. W. H. FISHER, Gen'l Pass. & Tk. Agt.
FORT WAYNE, IND.

PITTSBURGH AND LAKE ERIE RAILROAD.

"Cleveland & Pittsburgh Short Line."

Twenty (20) Miles Shorter than any other route between Cleveland, Pittsburgh, Washington, Baltimore and the South East.

5 Through Trains Daily 5

FAST TIME. NO DELAYS.

"For scenery picturesque and varied,
Through valleys green, 'mong mountains ser-[ried,
The people's favorite route I ween,
The P. & L. E. sits enthroned as queen."

See that your tickets read via
THE PEOPLE'S FAVORITE ROUTE.

E. HOLBROOK, Gen'l Supt., A. E. CLARK, G. P. & T. A.
Pittsburgh, Pa.

SCIOTO VALLEY RAILWAY.

Direct route, Columbus, O., to Circleville, Chillicothe, Waverly, Portsmouth, Ironton and Ashland, Ky. Three trains daily except Sunday. Favorite route, North and West, making close connection at Ashland, Ky., with the Chesapeake & Ohio Ry., through the canons of New River, passing White Sulphur Springs and the many Summer resorts of the Alleghenies in Virginia.

Shortest and Quickest Route to Richmond, Lynchburg, Newport News, Old Point Comfort.

J. ROBINSON, Receiver, Columbus, O. JNO. J. ARCHER, Gen'l Pass. Agt

---

—THE—
Cleveland & Marietta Ry.

THROUGH TRAINS
BETWEEN
Toledo, Cleveland and the Ohio River.

The shortest and best Route via Marietta to
Washington, D. C., Charleston, W. Va., Parkersburg, W. Va., and the South.

Direct connections at Union Depots, with all great through lines to all Points

WEST, NORTHWEST, SOUTH, SOUTH-WEST AND SOUTHEAST.

Lowest Rates. Quickest Time.
Best Accommodations.

Tickets sold and baggage checked through to destination. Reliable information and best rates will be furnished by any agent of the Popular C. M.

A. T. WIKOFF, Pres. and Gen. Mgr. W. K. RICHARDS, G. P. & T. A.

ERIE RAILWAY

THE FAVORITE
—AND—
PICTURESQUE ROUTE
—TO—
New York, Boston and the East.

The shortest and quickest Route to Pittsburgh, Washington and Baltimore & the Southeast.

New Central Depot So. Water St. and Viaduct

	Depart.
No. 62, Accommodation.....	† 6 05 a m
No. 72, New York & Pitts. Express....	* 8 10 a m
No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 45 p m
No. 73, Leavitsburgh Local.....	* 2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No. 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

*Daily. †Daily, except Sunday.

Baggage checked through to all points East.

Through tickets and information regarding the route can be obtained at office, 141 Superior street, and at Depot N. Y., P. & O. Railroad, South Water street and Viaduct, Cleveland.

A. M. TUCKER, Gen. Supt., Cleveland, O.
W. C. RINEARSON, Gen. Pass. Ag't, New York
G. K. FOUTS, C P. & T. A., Cleveland.

THE BEST PULLEY ON EARTH.

IRON ARMS

AGENTS WANTED

OHIO PULLEY & MACHINE CO.
WARREN, OHIO

THE HAZELTON TRIPOD BOILER

Furnishes more steam with less fuel, and generates steam more rapidly, than any other boiler in use.

Cleveland References:

J. W. BRITTON, Esq.,
WOODS, JENKS & CO.,
W. S. TYLER WIRE WORKS CO.,
CLEVELAND FORGE & IRON CO.,
BISHOP & BABCOCK CO.,
CLEVELAND SAW MILL & LUMBER CO.
CHERRY VALLEY IRON WORKS, Leetonia, O.

Address: **THE HAZELTON TRIPOD BOILER CO.,**

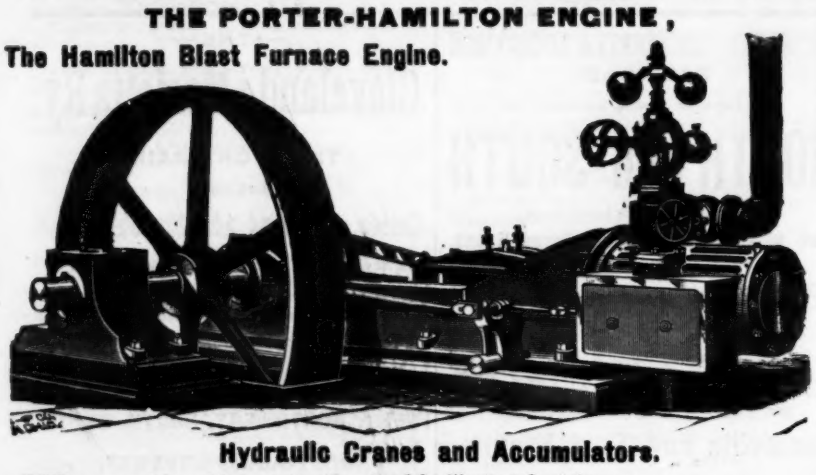
CHAS. HALLETT, AG'T, The Hollenden, Cleveland, Ohio. 170 TWENTY-SECOND ST., CHICAGO, ILL

WHO ALSO OFFER THE HAZELTON PURIFIER & HEATER.

WILLIAM TOD & CO., Youngstown, O.

THE PORTER-HAMILTON ENGINE,

The Hamilton Blast Furnace Engine.



Hydraulic Cranes and Accumulators.

☞ Heavy special machinery generally. Send for illustrated catalogue.

E. H. JONES & CO.,

ENGINEERS AND CONTRACTORS,

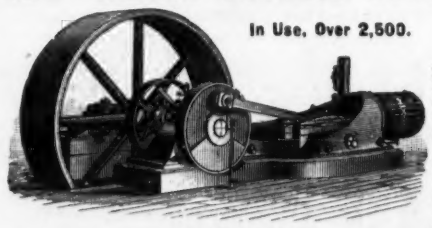
223-225 River St., CLEVELAND, O.

Steam Plants Complete. Engines, Boilers, Pumps, Heaters, Etc.
Steam and Hot Water Heating.

STURTEVANT'S BLOWERS, COILS, ETC.,

FOR HOT BLAST HEATING.

NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.



In Use, Over 2,500. **25 to 1,000 H. P.**

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail. Address **BUCKEYE ENGINE CO., Salem, O.**

SALES AGENTS:

W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt St., N. Y.
W. N. ROBINSON, 154 Washington St., Chicago, Ill. ROBINSON & CARY CO., St. Paul, Minn.

W. H. LaFountaine,

MANUFACTURER OF

VENTILATING FANS AND BLOWERS, HANGERS,

Carpet Cleaning and Laundry Machinery and other Special Machinery.

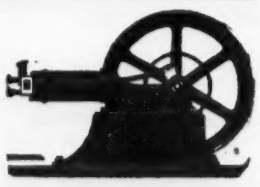
1335 Lexington Ave., - CLEVELAND, O.

Otto Gas Engine Works,

SCHLEICHER, SCHUMM & CO., { Philadelphia. Chicago.

Horisontal OTTO Gas Engines.
Vertical OTTO Gas Engines.
Twin Cylinder OTTO Gas Engines.
Combined OTTO Gas Engine Pumps.
Combined OTTO Gas Engine Dynamos.

SIZES: 1, 2, 4, 7 10, 15, 25 AND 50 HORSE-POWER.



SKINNER ENGINE CO. ERIE, PA.

OVER 3400 IN USE.

Manufacturers of PORTABLE & STATIONARY

ENGINES AND BOILERS

SEND FOR CATALOGUE.

NEW YORK and NEW ENGLAND OFFICE:
C. R. VINCENT & CO., 15 Cortlandt St., N. Y.

THE ÆTNA MEDIUM & HIGH SPEED ENGINE

Manufactured by THE ÆTNA MACHINE CO. WARREN OHIO

150 to 2000 H.P. Latest Design.

FOR ROLLING MILLS AND ALL OTHER WORKS WHERE LARGE POWER AND CLOSE REGULATION IS REQUIRED

CONTRACTS MADE FOR COMPLETE STEAM PLANTS.

ENGINES ALWAYS IN STOCK.

THE LAIDLAW & DUNN CO.

PUMPS OF EVERY DESCRIPTION. CINCINNATI, O. SEND FOR CIRCULAR.

HERCULES POWDER

SEND FOR DESCRIPTIVE PAMPHLET.

Stump before a blast. | Fragments after a blast.

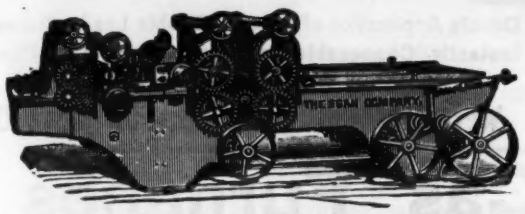
STRONGEST and SAFEST EXPLOSIVE Known to the Arts.

POWDER, FUSE, CAPS, Electric Mining Goods

AND ALL TOOLS FOR STUMP BLASTING,
FOR SALE BY THE
HERCULES POWDER COMPANY,
40 Prospect Street, Cleveland, Ohio.
J. W. WILLARD, Manager.

HERCULES,
THE GREAT STUMP AND ROCK
ANNIHILATOR.

THE BRIGHTMAN STOKER IS THE BEST
STEAM BOILER FURNACE IN THE WORLD.
SEND FOR DESCRIPTIVE PAMPHLET. THE BRIGHTMAN STOKER CO. 201-203 RIVER ST. CLEVELAND, OHIO.



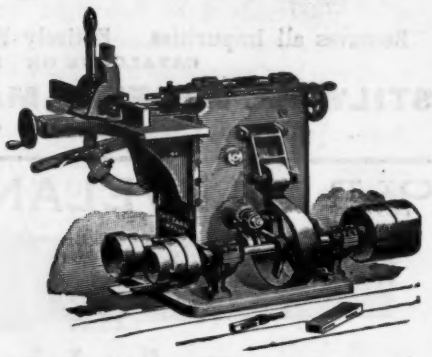
No. 7. Extra Heavy Double Planer and Matcher.
Planes 24 in. wide, both sides, and matches 14 in. wide. With Drop Matcher Attachment.

Complete Outfits Furnished for
Planing Mills.
Carpenter, Sash, Door and Blind Work.
Furniture, Chair and Bracket Factories.
Car, Railway and Agricultural Works.
Buggy, Carriage and Wagon Builders.
Spoke, Wheel and Handle Factories.
And General Wood Workers.

THE EGAN COMPANY,
NOS. 251 to 271 WEST FRONT STREET, Cincinnati, Ohio, U. S. A.

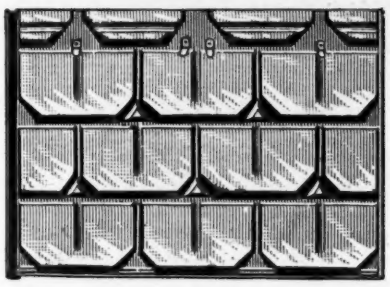
Builders of the Largest Line of Late Improved
WOOD-WORKING MACHINERY
IN THE UNITED STATES.

Send for Catalogue and Prices.



New Square Chisel Mortiser and Borer.

PERFORATED METALS OF EVERY DESCRIPTION BY THE HARRINGTON & KING PERFORATING CO. CHICAGO.
284 Pearl St., cor. Beekman. NEW YORK.



EASTLAKE METALLIC SHINGLES
Unequaled for
Roofing and Siding.
MANUFACTURED BY
W. J. BURTON & CO.'S
Galvanized Iron Cornice Works,
DETROIT, MICH.
Send for Illustrated Catalogue and Prices. Mention this paper.

GARRY IRON AND STEEL ROOFING COMPANY,
The Largest Manufacturers of Iron and Steel Roofing in the World,
MANUFACTURERS OF ALL KINDS OF
Iron and Steel Roofing, Crimped and Corrugated Siding, Iron and Steel Tile or Shingle, Fire-Proof Doors and Shutters, Iron Ore Paint and Cement.
Iron Frames for Roofs and Buildings.
No. 153 MERWIN ST., CLEVELAND, O.
Send for circular and price list No. A

CORRUGATED IRON
Seven sizes of Corrugations---Straight or Curved. We want to mail you the Finest Roofing Catalogue ever published.
THOMPSON M'F'G CO., Cleveland, O.

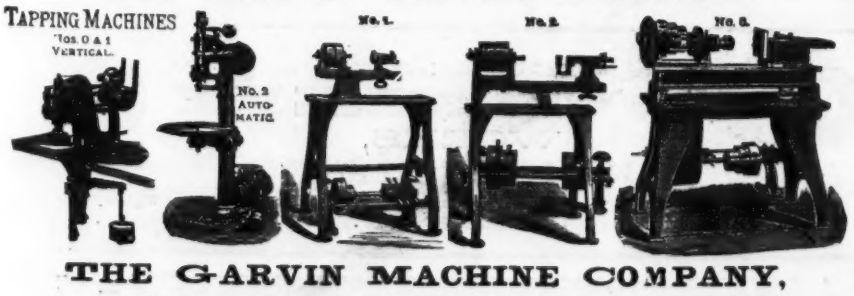
RGER MANUFACTURING COMPANY, CANTON, O.

DON'T make arrangements for ROOFING until you have seen ours.
It Excels all other Metal Roofs.

CAMBRIDGE ROOFING CO., Cambridge, O..

Manufacturers of
Plain, Rolled, Crimped Edge, Corrugated and Beaded Roofing, Siding and Ceiling.
PURE STEEL A SPECIALTY
Send for Descriptive Catalogue.

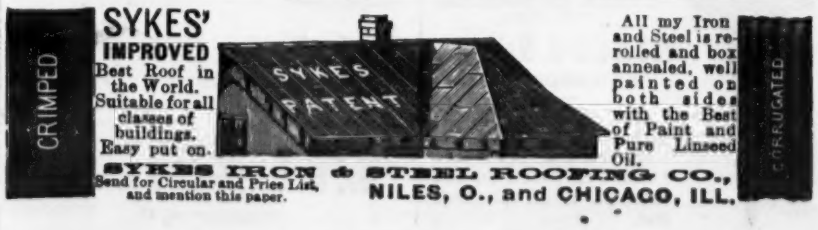
OUR LINE OF TAPPING MACHINES.



THE GARVIN MACHINE COMPANY,
Manufacturers of, and Dealers in, all kinds of
MACHINERY AND MACHINE TOOLS.
Universal and Plain Milling Machines, Drill Presses, Screw Machines, Hand and Engine Lathes, Planers, Profilers, Chucking Machines,
Gear Cutters, Die and Cutter Grinders, Tapping Machines, Wire-Spring Coilers, Milling Cutters, &c.
Plants for Manufacturers of Sewing Machines & Electrical Goods.
GEAR-CUTTING AND MILLING IN ALL ITS BRANCHES.
Laight & Canal Sts. [Catalogue sent on Application.] NEW YORK.

THE KANNEBERG ROOFING CO., Canton, O.
The Originators of Strictly Genuine Steel Roofing.)

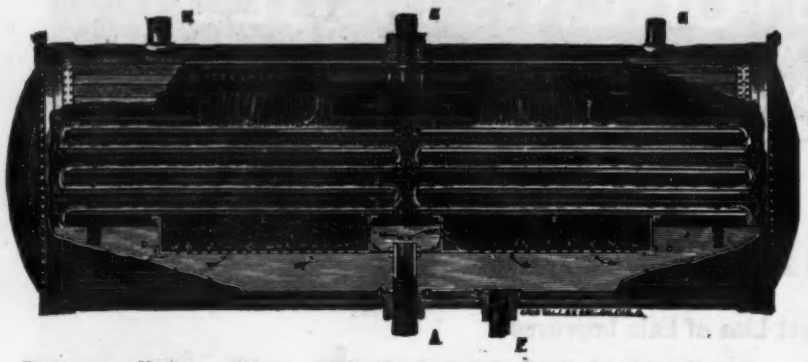
MANUFACTURERS OF THE
Kanneberg Pat., Latest Improved, Folded Lock Seam Roofing,
Made of STRICTLY GENUINE STEEL.
CORRUGATED IRON (four sizes of corrugations), and Crimped Edge Iron Roofing and Siding, Beaded Iron Siding and Ceiling, Water Proof Building Paper, Dry and Ready Mixed Paints, Etc
Write for Catalogues, Price Lists and Samples.


CRIMPED
SYKES' IMPROVED
Best Roof in the World. Suitable for all classes of buildings. Easy put on.
SYKES PATENT
All my Iron and Steel is re-rolled and box annealed, well painted on both sides with the Best of Paint and Pure Linseed Oil.
CORRUGATED

SYKES IRON & STEEL ROOFING CO., NILES, O., and CHICAGO, ILL.
Send for Circular and Price List, and mention this paper.

STILWELL'S PATENT LIVE STEAM-FEED WATER PURIFIER.

(HORIZONTAL STYLE.)



Removes all Impurities. Entirely Prevents Scale in SteamBoilers.
CATALOGUE ON PPLICATION.

STILWELL & BIERCE MANUFACTURING CO.
DAYTON, OHIO.

PORTBLE, HAND OR BELT **PIPE**

CUTTING & THREADING MACHINE.

Double Application of Power. Double Leader Screw
Instantly Changeable, range from 1 to 6 in. Pipe.
Write for Description and Prices

WELLS MACHINE WORKS, FOSTORIA, O.

Water Gas Furnaces

FOR LOCOMOTIVES, STEAMBOATS AND STATIONARY BOILERS.
A Perfect Smoke Burner.

W. S. HUTCHINSON. 325 Dearborn-st., Chicago.

OLD 1874. **CLEVELAND TWIST DRILL CO.,** RELIABLE 1890.

SEND FOR CATALOGUE. **Cor. Lake & Kirtland Sts., Cleveland, O.** WRITE FOR DISCOUNTS.

SAVES 10% TO 50% FUEL
AMERICAN HEAT INSULATING CO. LD
P.O. BOX 459
PITTSBURGH, PA.
PIPE & BOILER COVERINGS
INCREASES CAPACITY OF STEAM PLANT

The Hart or Detroit

Emery Corundum Wheels and Machinery.

Write to J. WENDELL COLE, M. E.,
District Manager, Box 152, Chicago, Ill., or Box 84, Columbus, O.

☞N. B.—Also Agent for WM. SELLERS & CO.'S SPECIAL TOOL GRINDER and TWIST DRILL GRINDER WITH POINTER, for Pennsylvania, Ohio, Indiana, Illinois and Wisconsin.

Awarded the GRAND PRIZE at the Paris Exhibition.

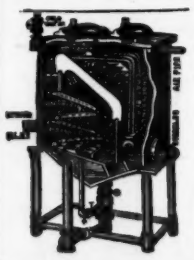
SEND FOR THIS BOOK
FREE ON APPLICATION.
THE BABCOCK & WILCOX CO
WATER TUBE
30 CORTLANDT ST. N.Y.
107 HOPE ST. GLASGOW, SCOTLAND.
BRANCH OFFICES
STEAM BOILERS
MANUFACTORIES IN UNITED STATES, SCOTLAND, FRANCE, GERMANY & AUSTRIA.

Cleveland Office, 412, Perry-Payne Building, Cleveland, O.

Penberthy Automatic Injector.

If you want an injector that is simple and reliable,
Use the Penberthy.
If you want an injector that is automatic and will restart, if from any cause the feed should be broken,
Use the Penberthy.
If you want an injector that works on 20 to 150 pounds steam pressure,
Use the Penberthy.
If you want an injector that you have only to turn the steam on and off, in stopping and starting,
Use the Penberthy.
If you want an injector to lift 20 feet or work from a head,
Use the Penberthy.

PENBERTHY INJECTOR CO., 117 7th St., Detroit, Mich.
C. H. PRESLEY, Agent, Cleveland, O.



WEBSTER'S "VACUUM" EXHAUST STEAM ECONOMIZER,
Feed-Water Heater and Purifier

Is the most perfect device known for HEATING and PURIFYING the FEED-WATER for steam boilers, preventing scale, and for HEATING BUILDINGS of any description, WITHOUT BACK PRESSURE on engines, returning CONDENSATION to the BOILER IN THE ONE APPARATUS. Readily cleaned without stopping machinery. All parts accessible.

FURNISHED ON TRIAL FOR ACCEPTANCE.

Before you decide upon the adoption of any Feed-Water Heater and Purifier, or any device for assisting the circulation of steam for heating purposes, (after receiving full information of every device in the market) we would be pleased to call upon you personally (at our expense) and explain, with convincing proofs, the superiority of Webster's "Vacuum" Exhaust Steam Economizer over all pressure, coil, tubular or open heaters. Send for New Catalogue.

WARREN WEBSTER & CO., Prop'rs, 491 N. Third St., Phila.
74 Cortlandt St., New York. 159 La Salle St. Chicago, Ill.

FILES

WE are sole agents for the State of Ohio for the celebrated K. & F. file. During the past eight years we have sold a good many thousand dozen with results most satisfactory to our customers and ourselves. For machinists' use especially we consider them without a superior, and much beter than the average quality sold. Our stock is large and well assorted.

THE PARKIN & BOSWORTH CO., 9 and 11 South Water Street, CLEVELAND, O.

GRAHAM TWIST DRILL CO., Detroit, Mich.,
Sole manufacturers of GRAHAM'S PATENT GROOVED SHANK TWIST DRILLS and CHUCKS. Endorsed by progressive mechanics everywhere. Send for Catalogue.

PRESSED WROUGHT IRON OPEN TURN BUCKLES.

BEST AND Cheapest.

The list retail price of this Buckle is less than one-half the wholesale price of inferior goods when we commenced to manufacture, and dealers, even in small towns, find it profitable to carry a stock to sell with iron for tie rods

CLEVELAND CITY FORGE & IRON CO., CLEVELAND, OHIO.

CLEVELAND
GALVANIZING WORKS,

H. H. HODELL & CO.,
Galvanizing in all its branches, and Manufacturers of Rubber Buckets for chain pumps.
CLEVELAND, OHIO.

REYNOLDS BROS.,
MANUFACTURERS OF
Hand Cut Files
AND RASPS.
We solicit the commercial trade only.
133 & 135 N. Water St.,
COLUMBUS, OHIO.

Old Files Recut and Warranted Superior to any Machine Cut and Lead Tempered in the market. Send for price list.

WELLINGTON
Belt Holder.
Recent Improved.

BETTER THAN LOOSE PULLEYS.

Shifts Belt from Driving Pulley.

Belt stops when machine stops and lies slack until machine starts. Simple, cheap, easily operated. Sent on approval. Thousands in use. Address

W. R. SANTLEY & CO.,
Wellington, O.

Jobbers of all kinds of **Roofing Materials.**

WM. EBERTS. ESTABLISHED 1871 J.M. EBERTS.
EBERTS BROS,
MANUFACTURERS OF
CORRUGATED IRON ROOFING, SIDING & CEILING.
OFFICE AND WORKS 192 to 198 HIGH ST. WEST
DETROIT, MICH.

PRESSED STANDING SEAM, V Crimped and Roll Cap **IRON ROOFING.**